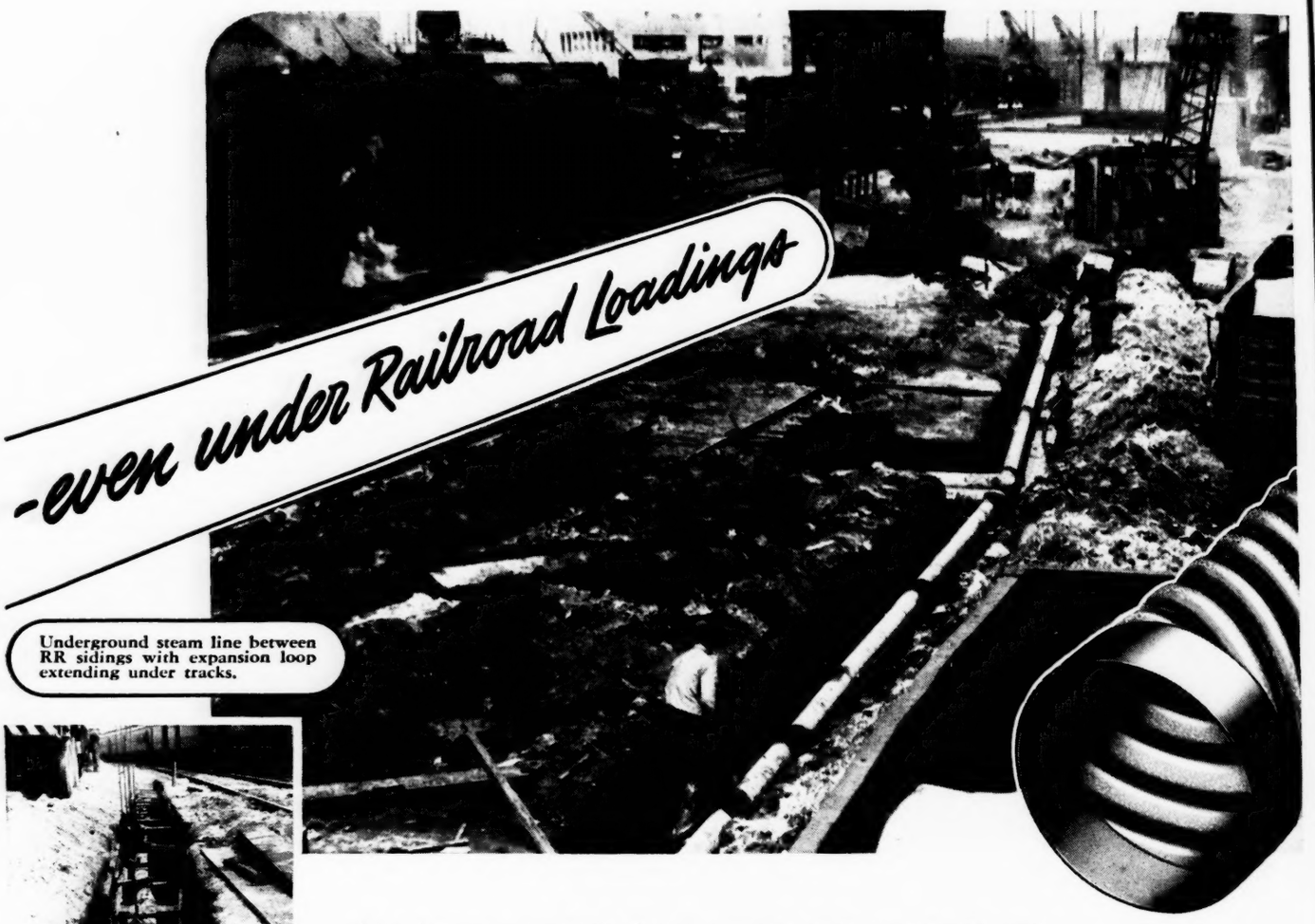
HEATING AND VENTILATING

AIR CONDITIONING, REFRIGERATION, PIPING, AIR SANITATION, HEATING AND VENTILATION

Wardell-Sheraton Hotel, Detroit, served by district heating system. See Reference Section, page 63

FLEXIBILITY *and* STRENGTH *of* RIC-WIL CONDUIT PERMITS SHALLOW INSTALLATION *of* STEAM LINES

-even under Railroad Loadings

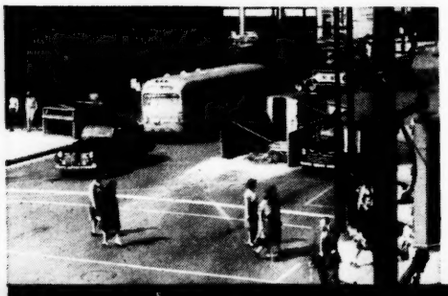


Underground steam line between RR sidings with expansion loop extending under tracks.

21 ft. Ric-wiL Prefabricated Insulated Pipe unit lowered into trench alongside tracks at RR passenger station without interrupting rail traffic.

The heavy-gauge helically corrugated shell used in Ric-wiL Prefabricated Insulated Pipe Units makes possible a resilient construction of high beam strength, which can safely be installed under E72 RR loadings with only 3 feet of ground cover, and under E90 loadings with only 5 feet. Because of this and other exclusive Ric-wiL features, the trend of engineering departments of railroads is to specify Ric-wiL for all underground steam lines. It is possible to jack Ric-wiL through existing right-of-ways and to install steam lines without disturbing sidewalks, pavement or tracks and without permanent deformation of roadbeds, thus saving both installation and maintenance expense.

Secret of the strength and flexibility of Ric-wiL units is in these corrugations. Seam-welded, helically corrugated, heavy gauge galvanized iron shell with full round smooth ends and special Ric-wiL coupler, provide pressure-tight construction.



(Left) Normal traffic was maintained on this busy downtown street while Ric-wiL units were installed under pavement. Units were jacked through from building basements and joined to utility's steam main at manhole in center of street. *(Right)* Close-up of manhole showing auger crew and tool for drilling under pavement.

See our exhibit at 17th National Exposition of Power and Mechanical Engineering, Grand Central Palace, New York, Booths 38 and 39.

RIC-WIL INSULATED PIPE CONDUIT SYSTEMS

THE RIC-WIL COMPANY · CLEVELAND, OHIO

AGENTS IN PRINCIPAL CITIES

VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL AIR CONDITIONING, REFRIGERATION, AIR SANITATION, PIPING, HEATING AND VENTILATION

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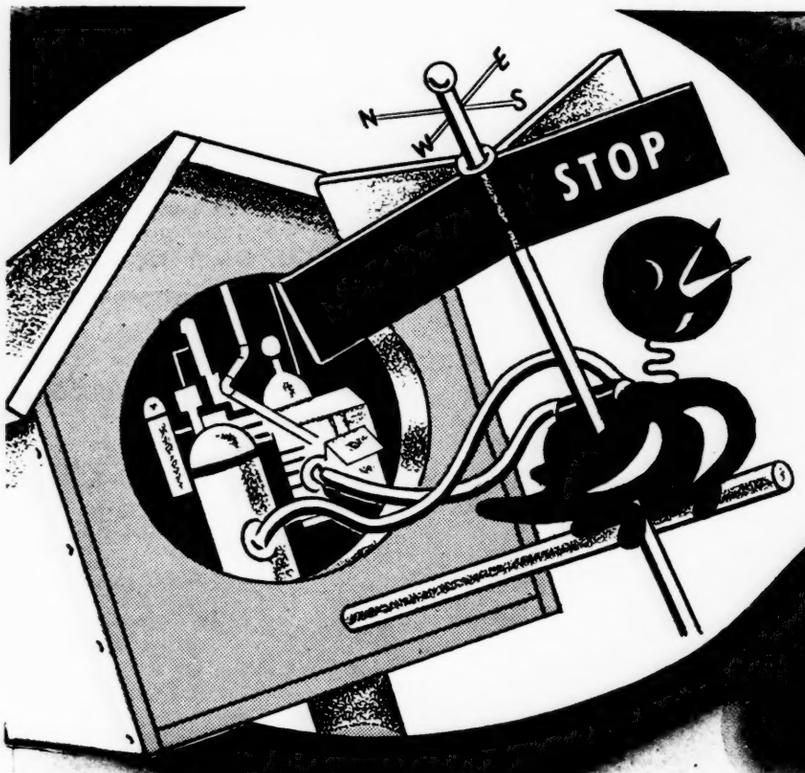
MEMBER
Audit Bureau of Circulation
Associated Business Papers

THIS MONTH'S COVER

The Wardell-Sheraton is a 12-story apartment hotel in Detroit that was originally served by its own steam generating plant. It has recently changed over to purchased steam. The changes necessary to make this conversion are described by a Detroit Edison Co. engineer on page 71.



SO...

They Built Bird Houses to Beat the Weather

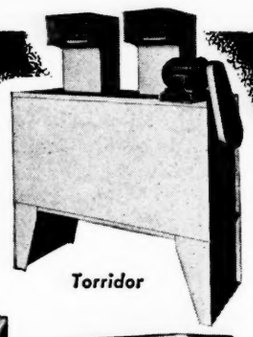
HOW ACCU[illegible]ING TESTS ARE MADE DESPITE CHANGING WEATHER CONDITIONS

To test a newly developed product, Trane engineers must determine performance and compare it with that of similar units. To be accurate, such tests should be made under identical conditions. Because they want to know how new products and systems will perform in actual use, Trane engineers perform their tests in a special test house that is exposed to the weather on every side.

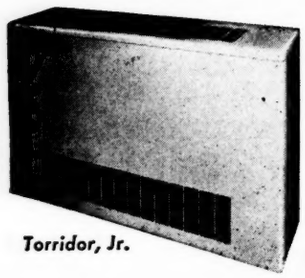
When constantly changing outdoor temperatures are involved, testing becomes a problem. Trane engineers were faced with the choice of waiting for identical weather conditions to recur or devise some means of making the "weather stand still." That's where the the Effective-degree-day Meters — "Bird Houses" for short — come in.

These devices, utilizing thermal and electrical principles, are contained in small boxes that are hung in strategic spots on the exposed walls of the test house. Each unit registers a different set of conditions, and these readings are averaged to record the total outside weather effect on the entire building. With this ingenious arrangement, Trane engineers measure changing weather and "cancel out" day-to-day variations to make exacting tests whenever they please.

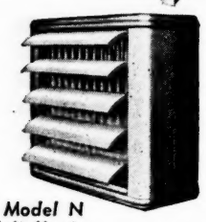
Projection Heater



Torridor



Torridor, Jr.



Model N Unit Heater

TRANE UNIT HEATERS . . . MOST WIDELY USED . . . MOST WIDELY USABLE

The four outstanding Trane Unit Heater types cover a range of sizes and capacities to meet every heating requirement. There is a Trane Unit Heater to provide quick, economical heat for any application, from a huge assembly floor to a handsome, quiet office.

1—*The Trane Model N Unit Heater*, a conventional model, uses a special broad bladed fan to move large quantities of air. 2—*The Trane Projection Heater*, pioneered by Trane, tucks up under the ceiling, yet adequately heats a broad area. 3—*The Trane Torridor*, a blower type unit, is recommended for those areas where a long distance of throw is necessary or against the resistance of ductwork. 4—*The Trane Torridor, Jr.* combines the advantages of a blower unit heater with the attractive cabinet of the Convector-radiator.

Washington News

LORING F. OVERMAN

Pattern of Decontrol.
Building Men Meet.
What About Rent.
Supply and Demand.

THAT the price of steaks and chops will have a direct bearing upon the operating pattern of the heating, ventilating and air conditioning industries during the next few months may seem a far-fetched conclusion. Yet there are indications that the government's October action in decontroling meat and food prices will require a complete reshuffling of the cards in all phases of business.

The call for a new deck stems from the conclusion that scuttling of food prices—months ahead of the time originally contemplated—signals the beginning of the end of virtually all wartime controls over prices and the distribution of materials. The ending of controls, it appears, was not in accordance with the wishes of most of those within government. Nor was it due to the activities of pressure groups from without. Instead, over and above such possible considerations as political expediency, the action was reportedly due to public pressure from millions of individuals who no longer respected government control because they believed it had outlived its wartime usefulness.

Continued Controls

Which few items, if any, that will remain under control are in doubt, but it would appear that ceilings will remain on rents, automobiles, domestic refrigeration, building materials, tin, copper, lead, zinc and basic steels—with upward adjustments.

Building materials are also expected to remain under both price and allocation procedures, but there is increasing doubt in Washington that segments of an economy can be held in check while others have been freed. If removal of price control on meats and other freed items actually succeeds in breaking the bottleneck which business has long claimed interferes with the orderly flow of goods, the Wyatt plan of subsidy and diversion of materials to veterans' housing will experience a quick blackout.

For the present, Wyatt has the bit in his teeth and is determined to follow through on present lines regardless. His latest action, it will be recalled, reduces to $1,000 the amount of factory repair or new construction that can be started without approval, unless the building has or will have more than 10,000 sq ft of floor space upon completion of the project. Previous exception was $15,000 for such manufacturing projects. If the pressure for decontrol should cut across his veterans' housing program, administered as he believes it should be, Washington would not be surprised to find a Wyatt resignation on the President's desk.

Building Industry Gunning

The recent break in decontrol schedules offers new ammunition for the meeting of representatives of 100 trade associations in the construction field, called for November 20 and 21 at the Washington headquarters of the Chamber of Commerce of the United States by the Construction Industry Advisory Committee. This delegation is expected to draft recommendations for a change in the present government system of handling construction problems. An advance draft of the proposals, although not approved as HEATING AND VENTILATING went to press, suggested scrapping of all government controls over building material pricing and allocation.

"The basic purpose of the meeting is to develop constructive plans for increasing the productivity and efficiency of the industry in order to meet pressing demand for large volumes of new construction in both the residential and non-residential fields," said John C. Stevens, Council Chairman, a past president of the American Society of Civil Engineers. "The gathering will provide an outstanding opportunity to demonstrate clearly the determination of private industry to expand its services in spite of serious difficulties.

"Accumulated shortages in both residential and non-residential categories are so unprecedentedly large as to obscure the major accomplishments of the industry during the reconversion period. From a virtual standstill, it has rapidly achieved a volume well above the prewar average. Yet even this is not enough, for only the most pressing needs are being met. If the American people are to get the homes and other structures they need within a reasonable time, much more must be done."

To permit prompt consideration of recommendations expected to be developed at the Council meeting, a meeting of the U. S. Chamber's Construction and Civic Development Department Committee has been called for November 21.

Kilgore Eyes Wyatt

Further evidence that Wyatt's path is not one of roses is the fact that the American Legion, at its recent convention in San Francisco, took "under advisement pending investigation," Wyatt's plea for an endorsement of his efforts. Too, Senator Kilgore's War Investigating Committee has decided to look into the bottlenecks holding up housing, with the idea of determining who is responsible. Whatever Mr. Wyatt may think of the investigations, it is reported that they are welcomed by the construction industry. The construction industry takes the position that the considerable progress in home construction has been made at the expense of other segments of industry. The channeling of so high a percentage of basic materials into residential construction is, they claim, partly responsible for the inability of automobile manufac-

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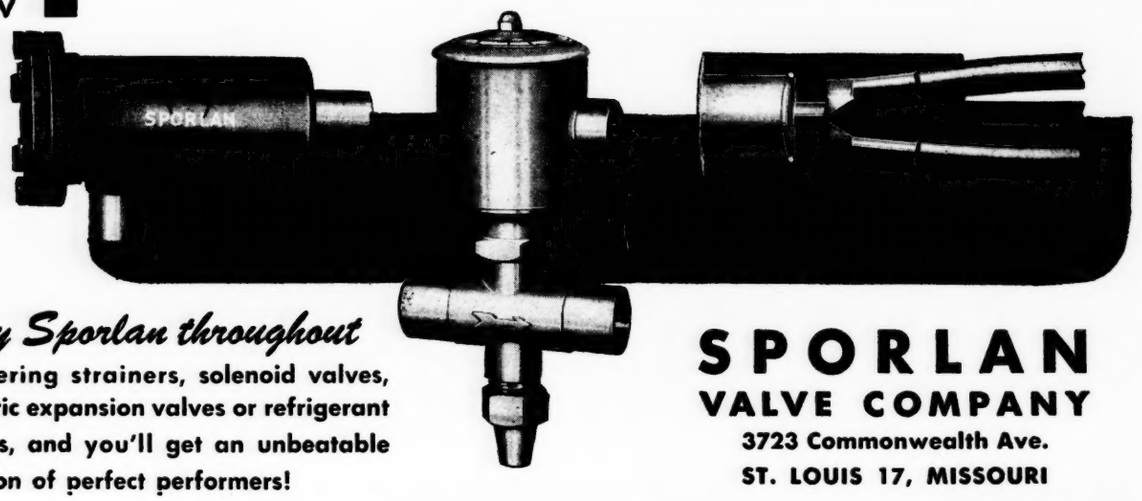

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turers and other producers to find enough materials to meet needs.

Armed with evidence that the meat industry was able to prove that it could produce only if relieved of restrictive controls, it may be expected that the building industry will swarm to Washington in November with similar ideas in mind. In addition, the industry will be able to offer evidence that despite all the government devices of price controls and adjustments, allocation of materials, limitations on competing uses, and various other expedients, the present program has not yet succeeded in producing a satisfactory number of finished, habitable homes.

Rents vs. Building Costs

In all appraisals of the future outlook for price control, public opinion seems resigned to decontrol of about everything "excepting rents." This subject will doubtless enter into early Washington discussions, for building circles appear to agree that there is little inducement to erect rental housing at present rates when construction costs are at least 60% above 1939 prices. Since government seems to be taking its cue from public opinion, a hike in rent ceilings seems more likely than decontrol in this field. Rents are reported only 4% higher than in 1939, with a number of landlords favoring rental strikes to enforce their demands for increases, and with contract awards for rental housing projects dropping sharply from the peak reached in May.

Deflation Due?

A new line of thinking, involving deflation rather than inflation, has appeared in Washington since the decontrol of food prices signaled a change in policy. True, the original plan of OPA involved a gradual easing of controls so that neither deflation nor inflation would be a sudden jolt, but with the scrapping of the wage policy the pattern was broken and no one will ever know whether the cushioning effects would have really worked. OPA planners will doubtless contend for all time that if they had been given their way, things would have been better, but with business blaming OPA for bottlenecks even during the period when OPA was functioning under wartime conditions with a considerable degree of public support, there is plenty of room for doubt.

In any event, business has steadfastly contended that while the removal of controls might result in a momentary upward surge, the resultant balancing of supply and demand would level out the price structure within a reasonable time. Now, however, there is a tendency in Washington to conclude that for most things the top has virtually been reached, and that the next major movement will be downward. A feeble upward swing in some prices is anticipated, but indications are that it will be short-lived.

Those who take this view hold that the unexpected break in government price policies—months ahead of the scheduled end of OPA next July—has merely advanced the postwar recession by the same number of months, and that business will be wise to make its plans accordingly. As these analysts see it, the production peak will be reached during the fourth quarter of this year, at about 178% of the 1935-38 average on the Federal Reserve Board index... with the bottom of the decline at about 140 on the FRB index by the end of 1947. They then foresee about three months of business at that level early in 1948—ending 1947-48 with a decline of 21% below the 178 peak.

For durable goods, the prediction involves a drop from the present 212% of 1935-39 average to 152% by the end of 1947.

Many Ramifications

If predictions of a recession in 1947 are accurate, instead of the previously-mentioned 1948 or 1949, some early changes in business planning are in order. A downward trend in prices can reflect only a slackening of demand, due partly to release of incompleted inventories, and partly to buyers having been priced out of the market. A slackened demand, in turn, involves curtailment of sales planning, production scheduling, raw material purchases, plant expansion for the producer, and office expansion for the professional man.

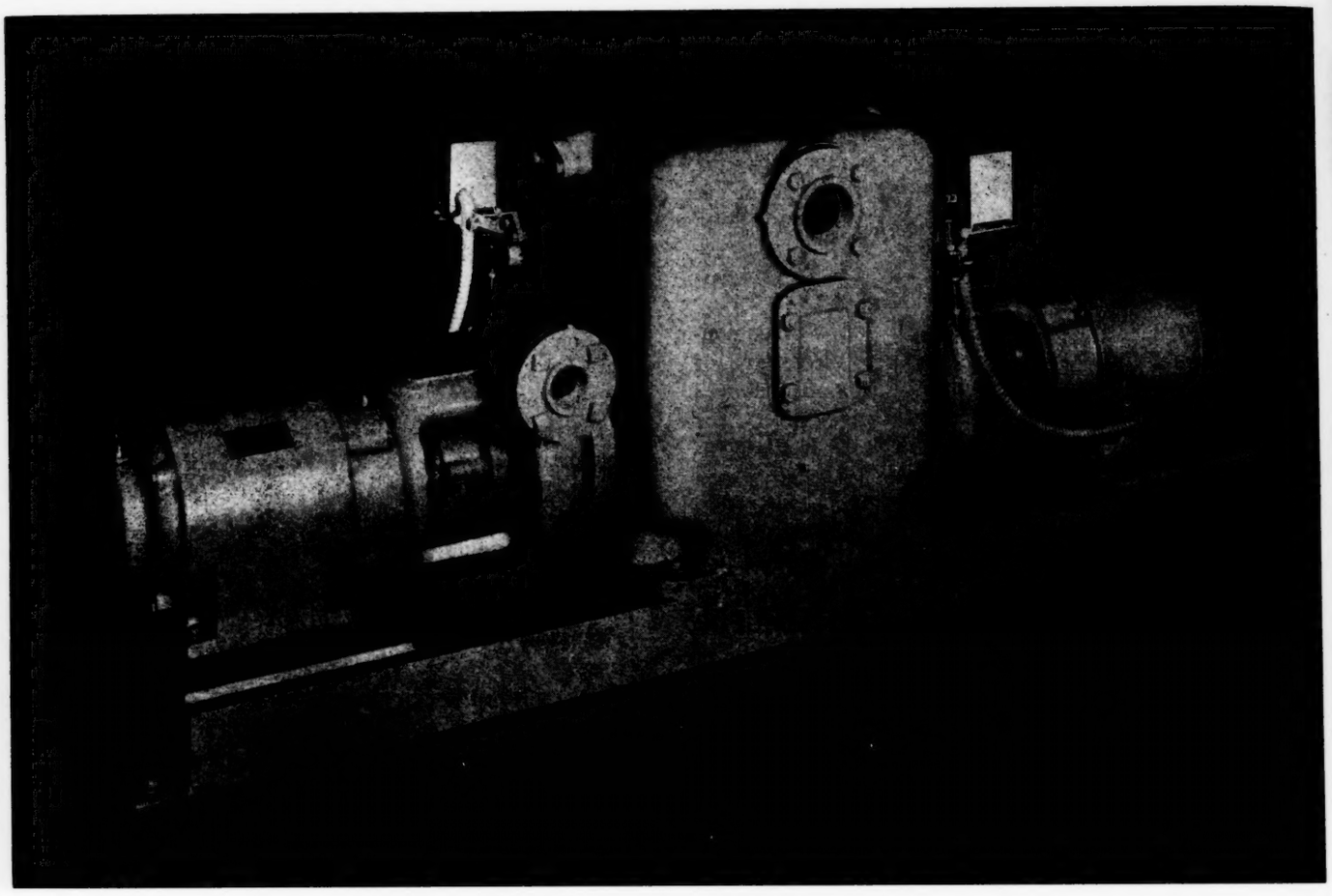
Too, it places labor union leaders in a peculiar spot. It has been widely assumed that decontrol action by OPA would signal another round of wage increase demands by labor. This is still a possibility, but labor organizations too have their economists and long-range thinkers, and if they should come up with the 1947-recession conclusion, they will find themselves in an unfavorable period from a bargaining standpoint. Receding living costs—with the probable exception of rent—would rob them of their customary cost-of-living adjustment weapon. Return of more than a million GI's to the labor market following expiration of their membership in the 52-20 club would have a bearing on the subject, as would layoffs due to the predicted drop in overall production.

There is also evidence that much labor has been inventoried during the period of scarcity by manufacturers awaiting price relief as the signal to go ahead full speed. With the first sign of a turn in the tide, such excess inventories of labor would be quickly analyzed. If labor is as quick to sense a possible disadvantage as it has been to step on the gas when the light appeared green, there may be fewer big-industry strikes and work stoppages in 1947 than have been anticipated. Expect, however, a considerable number of "quickie strikes," hurried into action to beat the possible recession—right now, while the skyrocket is in its upward zoom.

Supply and Demand

Whatever the outcome of the speeded-up trend toward decontrol, it appears that business is soon to be more or less "on its own" again, and that management will have a chance to try out for the first time since the war, the effects of the law of supply and demand. Although current decontrol activities release food products primarily, the pattern appears to have been set, and those who have not been permitted the freedom of the food groups will bring all possible pressure to bear to prove that a half and half policy on decontrol will be no more satisfactory than the OPA brand of planning.

MAXIMUM EFFICIENCY FOR STEAM HEATING SYSTEMS ON HEATING, DRYING AND PROCESS WORK.



JENNINGS CONDENSATION PUMPS

Designed for steam systems on heating, drying, or process work, these pumps offer the most reliable and efficient means of returning hot condensate to boiler or hot well. In many cases these pumps will save costly installation of boilers in a pit to provide gravity flow of returns from basement radiators and heating devices.

The Jennings Condensation Pumps are sturdy and compact in construction, and combine receiving tank, pump and driving motor in a single assembly. Pumps are bronze fitted throughout, with tobin bronze shaft. The pumping impeller is of special design, made possible by our wide experience with return line heating pumps, and is especially adapted for handling hot water with the greatest possible efficiency.

Full automatic control is furnished by means of a ball float and float switch mechanism mounted on the receiving tank. All wiring is made up at the factory, and it is necessary only to connect the pump to the system and hook up the leads. Complete information regarding these economical pumps sent promptly on request.

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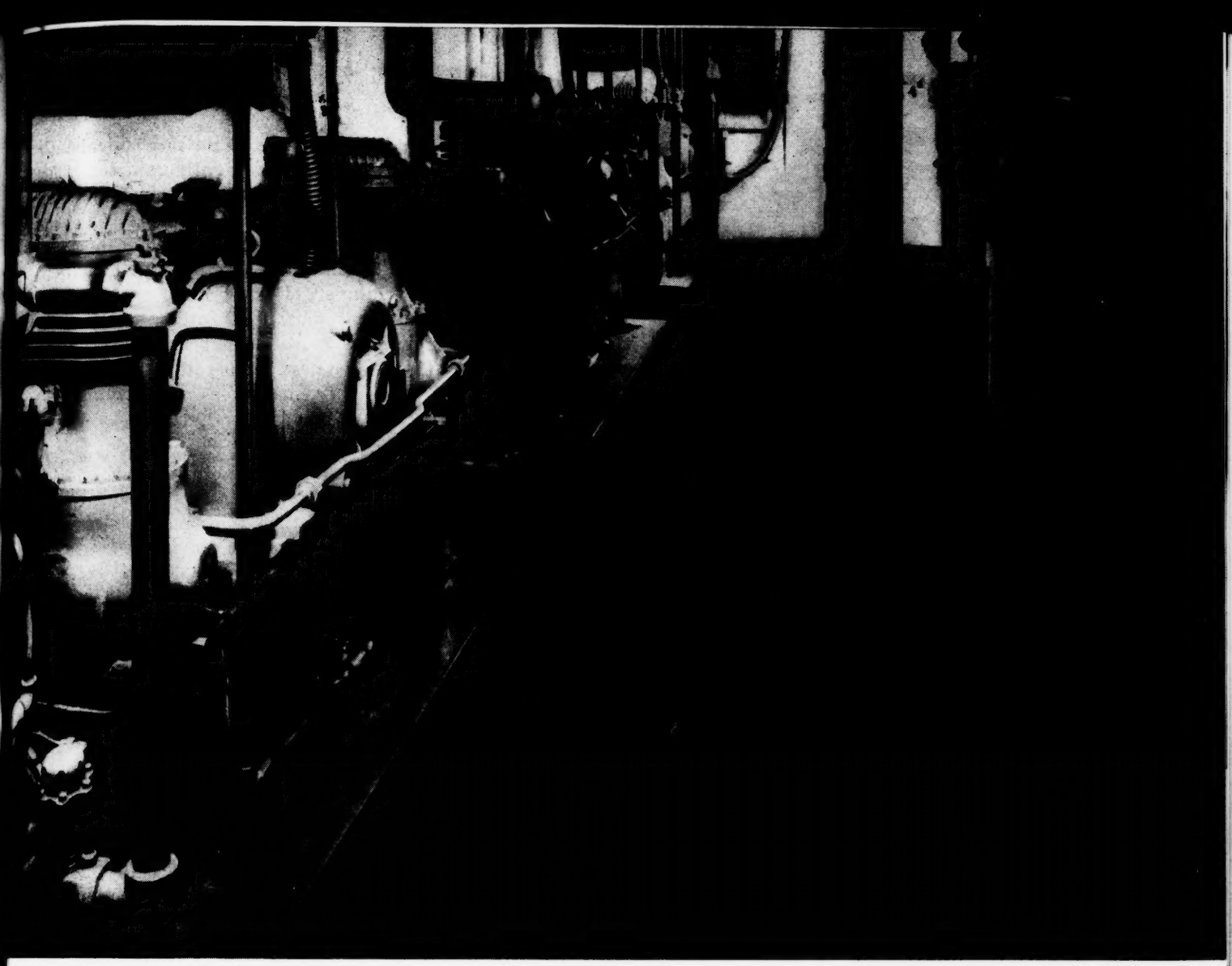


FRANK STEIXNER

Chief Operating Engineer, Longchamps Restaurants

Installation, operation, and maintenance of air conditioning, ventilating and heat equipment in the 12 restaurants of the Longchamps chain in New York City.

MANY factors must be considered for the efficient operation and maintenance of air conditioning equipment — particularly for equipment installed in large modern restaurants where the proper handling of air is so important.

In the Longchamps chain of restaurants in New York City, centrally located plants are employed with an average refrigerating capacity of 100 tons. Since the cooling plants were designed for 95F dry bulb and 75% relative humidity, and this condition is seldom experienced, the cooling plants have a 20% reserve capacity, even with severe operating conditions.

Restaurant size, ceiling height, and load calculations influence the air output but in general this varies from 40,000 to 70,000 cfm with 6 to 8 air changes per hour to obtain a fresh air feeling in the air conditioned spaces. Except under extreme temperature conditions, there is a constant 30% fresh air intake.

HEATING AND VENTILATING

Air Cleaning and Treatment

With the exception of the system that serves the Empire State Building restaurant, air is cleaned by means of throw-away type filters installed in banks of sections four deep. By periodic forward movement of alternate filters, the air emerges through the cleanest filter.

At the Empire State Building restaurant dry type filtering cells are used. The filtering medium is a thin gauze-like paper of several layers which is installed by special machine that feeds and folds the paper into the sections of a filter frame. Since the fresh air has been filtered initially at the point of intake, these filters are changed but four times a year.

As a means of killing outside air odors or those transported by the recirculated air, ionizing apparatus is used, the air is twice

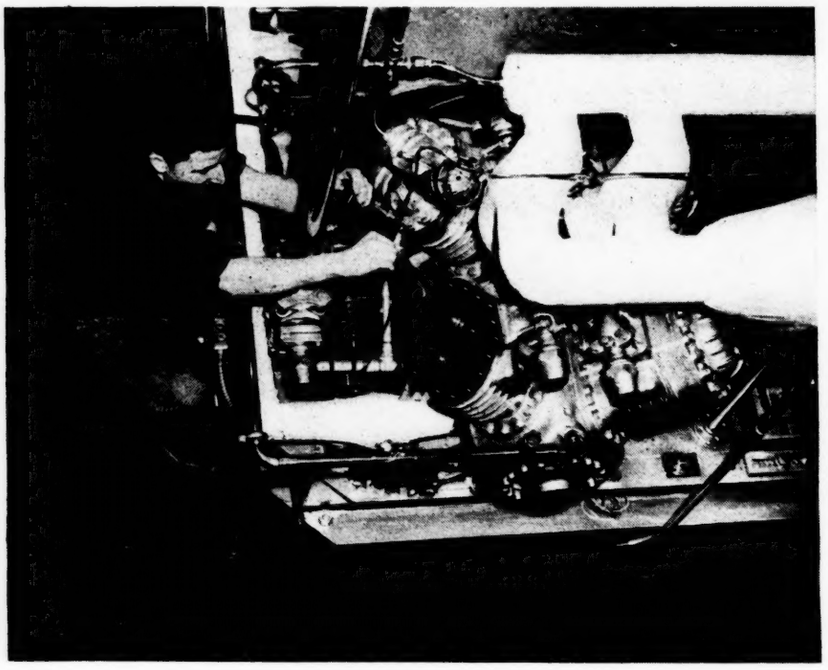


Fig. 1. Overhauling a 50-ton compressor driven by a 50-hp G.E. motor.

filtered before it is introduced to the ionizing machine.

Although a casual examination of the public dining areas may indicate an apparent lack of grilles and air outlets, they are there, nevertheless. They are hidden in indirect lighting coves or are blended with structural and decorative schemes. Grilles of several types are used. Adjustable blades which control the direction of air discharge are desirable in some cases and volume control is necessary to avoid drafts.

Additional control of air volume and air distribution is obtained through motor speed regulators, damper and vortex control.

One of the greatest ventilation problems in restaurants is the proper removal of cigarette smoke. Since smoke conditions are greatest at bar areas, particularly at peak business periods and cocktail time, a special smoke removal system is used that is separate from the balance of the ventilating system. Special smoke removal fans and vents that are installed provide efficient smoke removal.

Rest room ventilation requires a positive means of exhaust and this is usually accomplished by a grille placed over each set of two stalls. It is our practice to constantly pump a sufficient quantity of air to toilets.

We have some installations where a portion of the cooled air from the dining room is directed to the ventilation of toilets. One advantage is that the air thus supplied is cooler and lower in moisture than if outside air were drawn in for toilet ventilation.

Even the telephone booths are ventilated. A small exhaust grille is placed in the booth ceiling to draw off smoke and odors. This booth grille is connected to the general exhaust system and control is by finger type adjustable grilles and branch damper levers.

Zone Control

Unnecessary use of equipment is prevented by zoning which avoids cold or hot spots in the dining rooms and enables adjustment in the mechanical units used when a zone is lightly occupied. This is particularly true for restaurants located in commercial areas where there is a sharp drop in occupancy during such off-hours as after-lunch, before the cocktail hour, and after dinner. During these slumps, zone equipment can be throttled down to a minimum to satisfy operating demands. There is no need to operate an entire plant because only small areas need cooling.

Compressor Installations

Refrigeration units, in most of our installations, are series or multiple-series connected so that they may be run together or separately to provide greater flexibility of operation. Should one unit develop mechanical trouble that would require a shut down, the other can be run with little actual loss of refrigerating effect.

Compressors installed are from 10 to 50 tons each and since there is some similarity in the installations for the various units, some parts are interchangeable. This was particularly advantageous during the war years when certain parts were difficult or impossible to obtain. It provided a safeguard that meant the difference between a cool and comfortable dining room or hot, unbearable conditions. Where chain stores are centered in one locality, as the Longchamps group, an attempt to standardize on unit size and design is important.

Condensers

Condenser equipment commonly used includes the enclosed type multi-pass shell and tube type and the indoor evaporative condenser. In addition, on one of our installations, we use well water for condensing.

Aids in economical plant operation are automatic water pressure regulating valves actuated by head pressures, automatic float valves, thermometers installed in both inlet and outlet water lines of condenser, receiver seal test valves and liquid line indicators.

At periodic intervals, compressor equipment is taken down for testing of the gas and water sides, for cleaning and for renewal of gaskets. Mechanical units, traps, coolers, strainers and valves are inspected and repaired if necessary.

Controls

Our plants are provided with controls that are fully automatic on the air distribution and control end, or semi-automatic as far as the refrigeration operation is concerned. Controls provide full or semi-automatic operation, or manual control. The turn of a valve or switch provides the type control selected.

Pneumatic air control systems are provided with two compressors, cross connected, so that either can be used in the event of motor or compressor trouble. Complete failure of the control system would not mean interruption of service as the operator can carry on with hand control. He would be guided by the many

gauges and thermometers which were wisely provided at various points for checking.

Heating

Although we have standardized on heating methods with steam supplied by the building in which the restaurant is located, applications may vary with the peculiarities of each installation. Direct and indirect stacks are used, automatically controlled to meet the demand and inside and outside temperature conditions. Heating stacks are thin finned copper alloy tubes silver soldered to blocked distribution headers, and they are provided with bucket-thermostatic traps to handle the condensate return.

Fresh air intakes are designed to prevent the stacks from freezing. They have an automatic control which throttles the volume of fresh air and when the temperature of the entering air drops below 40F, a preheating stack or booster is placed in service.

Master and sub-master controls govern the initial air entering and leaving the central fan unit. Air, after passing through the primary stage, goes to the reheating stacks which furnish air at the proper room temperature.

Along the length of outside show windows are heavy finned type cast iron convectors inside of decorative cabinet type enclosures. These are individually controlled by thermostats placed in the immediate area and they have no direct connection with the rest of the heating system.

For the revolving doors at the street entrance, a blower heater unit in a drum is located on top of the door housing. Air intakes are placed on each side of the drum. A small amount of outside air is mixed with the room air, before being heated. Discharge is downward from the blower between the inside quarter sections of the revolving door. Control is obtained by three-point regulation of motor speed. Rapid action return traps, two installed on each of the double return to insure performance, handle the condensate. Revolving door strips to prevent drafts and to keep out dust are replaced as soon as they show wear.

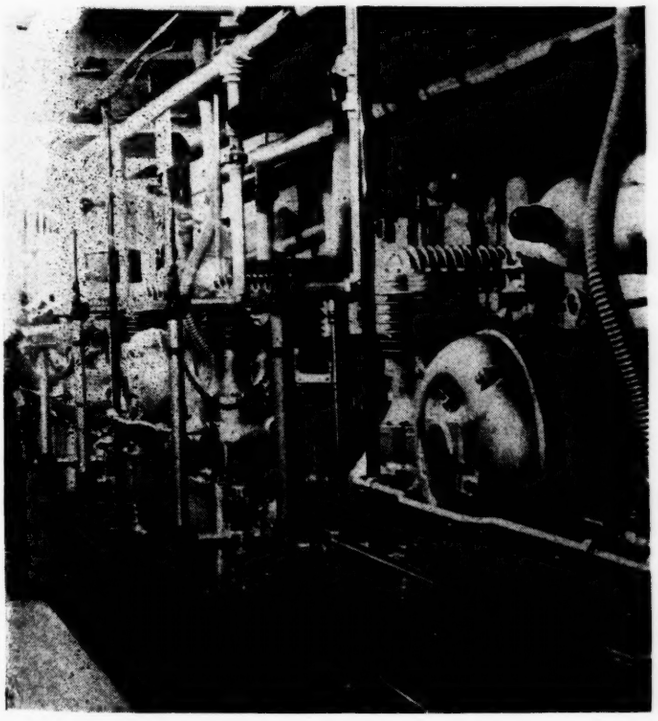


Fig. 2. Madison Avenue restaurant served by four air conditioning units of 25 tons each.

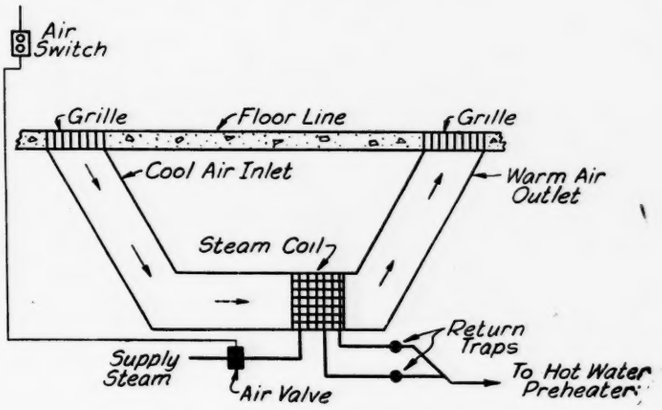


Fig. 3. Details of floor free heaters.

Four stores have drop front which during mild weather enables the front plate glass window and revolving door to be lowered to the basement. This provides the restaurant with an atmosphere of outdoor dining. Floor free heaters, consisting of duct work, are placed under the floor as shown in Fig. 3 and this design is also used where conventional radiators are not installed. In the duct is a steam coil that is double trapped to insure constant operation.

This gravity type floor heater has proved effective for the space that contains the coat racks. By heating the check room we offset the large amount of cold air that is brought in by the overcoats. This form of heating is used where a regular radiator would take up too much space and where sliding windows and disappearing store fronts would require the removal of the radiation each spring.

Returns from all heating equipment are piped to a preheater for the domestic hot water tank where the last of the usable Btu are extracted.

Heating equipment is checked periodically. The clean-up period for heating equipment is the late summer, at which time necessary repairs are made.

Kitchen Ventilation

Proper ventilation for kitchens is most important—not only from the generally accepted engineering side, but because due to the shortage of competent kitchen labor, it is mandatory that the kitchen staff be kept contented. To properly ventilate the kitchen of a restaurant in one of New York's tall commercial buildings means the solution of some interesting problems.

Let us take the distribution of fresh air in the kitchen. In the area where the gas burners are located for cooking, too much air will draw heat away from the broilers and ranges; too little will cause personal discomfort.

Kitchen-produced odors are removed before they have an opportunity to circulate generally through the

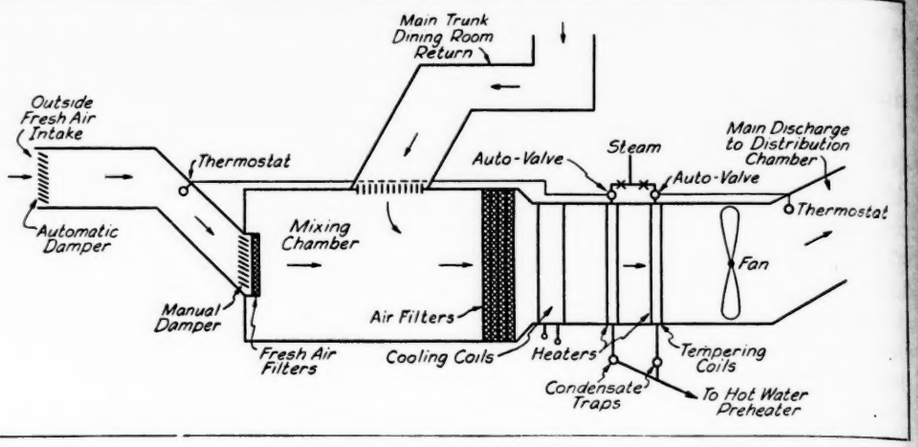


Fig. 4. Diagram of the cooling and heating equipment for the ventilating ducts.

kitchen. Special outlets are provided over the vegetable cutting tables for removing onion and other strong odors, and outlets in the area are placed where the dishwashing machines are located.

Heat-producing spots are provided with hoods individually designed for the equipment beneath. Hoods are connected by a system of exhaust ducts to an exhaust fan that is generally located at a building set-back well above the street level. Hoods are fabricated from stainless steel for durability, ease of cleaning and for appearance.

For example, the restaurant located in the Continental Building has the exhaust fan on the 26th floor set-back housed in a copper sheathed building. The fan is driven by a 20 hp motor and it exhausts 40,000 cfm at a velocity of about 2,000 fpm. This comparatively high velocity is required to carry the grease laden air to the point of discharge.

By keeping the volume of air exhausted in excess of that supplied to the kitchen, there is a positive flow of air from the dining room to the kitchen to prevent kitchen odors from reaching the dining areas.

So that kitchen exhaust may not be objectionable to tenants near the exhaust port, and to tenants of adjoining buildings, ozonating equipment is installed to neutralize odors. For one restaurant a 10-generator unit was installed. Care must be used that too much ozone is not introduced or some odors will be intensified instead of being reduced. Ozone is added at the final horizontal run or at a point 30 ft before the fan. Air used by ozonators is first filtered and then dried by dehumidifying equipment before the air is admitted to the ozonators. Dehumidifiers use alternate tanks of silica gel. An air pump, in connection with a 220-volt heating coil, is used to dry out the silica gel after every 72 hours of operation. One silica gel tank is on the line while the other is being dried and the switch-over is made by manually operated valves.

Grease Ducts

Grease ducts are cleaned by contracting firms specializing in that work and they clean the horizontal ducts once a month. For some restaurants the ducts must be cleaned every two weeks. Vertical ducts are not cleaned so often as most of the grease is trapped near the first long sweep before the rise.

When necessary a man must be lowered in a bosun's chair from the top of the drop to clean the vertical ducts. At the same time the men inspect the duct seams and caulk even the smallest hole. These cleaners also change canvas collars between the housing and ducts where this replacement is necessary.

Sound Isolation

All motors and compressors are mounted on anti-vibration beds to reduce the sound which may be transmitted through floors, walls, ceilings and beams. Fan housings are mounted or suspended on special vibration eliminators and all connections from fans to duct work are joined by canvas collars.

Much of the ductwork is lined with a material that not only serves as a sound deadener but also a heat insulator.

Flexible connectors are used on the larger water lines to condensing equipment.

Since vibration elimination is far more important than sound isolation, a check is made to insure proper alignment of pulleys, drives, belts, shafting and bearings, tension of belts, and the tightness of set screws and shaft keys.

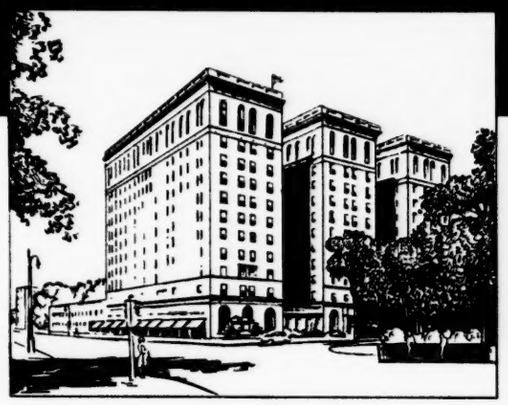
Besides, the ceilings of dining areas are covered with a sound absorbing decorative block.

Maintenance Work

Maintenance of all equipment is a full time job with work schedules so arranged that the men will have sufficient time for the periodic checks in addition to the regular duties. A definite program is followed religiously — proper lubrication, testing for leaks, examination of motors, bearings, pulleys, shaftings, oil levels, electrical connections, starters, switches, fuses. These are all periodic musts in accordance with a definite program.

Maintenance men are encouraged to give time and study to suggestions for better operation. The result is a better spirit of cooperation and a crew that works harmoniously as a unit. Such management can mean the difference between indifferent operation and careless maintenance, and successful and economical plant operation.

Good maintenance and careful operation are largely responsible for successful plant operation, and suitable credit must be given to the men who maintain and operate the equipment.



HEATING AND VENTILATING'S
Reference Section

District Heating in Detroit

Engineering and Economic Aspects

G. D. WINANS
Assistant Superintendent of Central Heating
The Detroit Edison Co.

Typical Application—Wardell Sheraton Hotel

C. B. SPRENGER
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District Heating In Detroit

G. D. WINANS

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District heating in the downtown section of a large city is treated from both the economic and engineering aspects. Distribution, water treatment and customer education are important factors in the growth of the Detroit Edison Co. district system.

THE term "district heating," sometimes known as "central heating," refers to the heating of several buildings from a single heating plant. It may apply to the heating of a group of buildings such as those of an institution or large industrial establishment, or as is practiced commercially in some 270 cities of this country for the heating of possibly several hundred buildings from one or more steam generating plants.

In 1944 sixty of some 270 district heating companies in the United States and Canada reported to the National District Heating Association a total steam sales of 48,454,000,000 lb of steam. This steam was sold to 24,450 customers. These same sixty companies had a maximum hourly output of 22,170,000 lb of steam per hour.

District heating is easily justified from several standpoints. It is far more effective to heat several moderate sized or large buildings from a single boiler plant rather than by individual plants in each building inasmuch as less operating labor is required, the costs of installing heating equipment are less, there is a saving in the use of fuel, greater reliability is assured, hazards are reduced, and cleanliness is improved.

District heating, as a commercial business, is one of the older public utility services, having been started at Lockport, New York, in 1879. The business has enjoyed a steady, although unspectacular growth. The impact of the war has brought about a marked increase in the popularity of the service. Because of labor and fuel problems, the difficulty in obtaining repair parts and operating supplies, and general increased costs, many building owners have contracted for district heating services. As a result, many district heating companies have found that their heating plants and distribution systems have insufficient capacity for the available business. A considerable number of companies have found it necessary to refrain from taking on additional customers.

District heating in Detroit dates back to 1903 if one or two earlier unsuccessful ventures are excepted. At that time, a company was founded to distribute and sell exhaust steam from an existing generating station. In the first two years 12,800 feet of under-

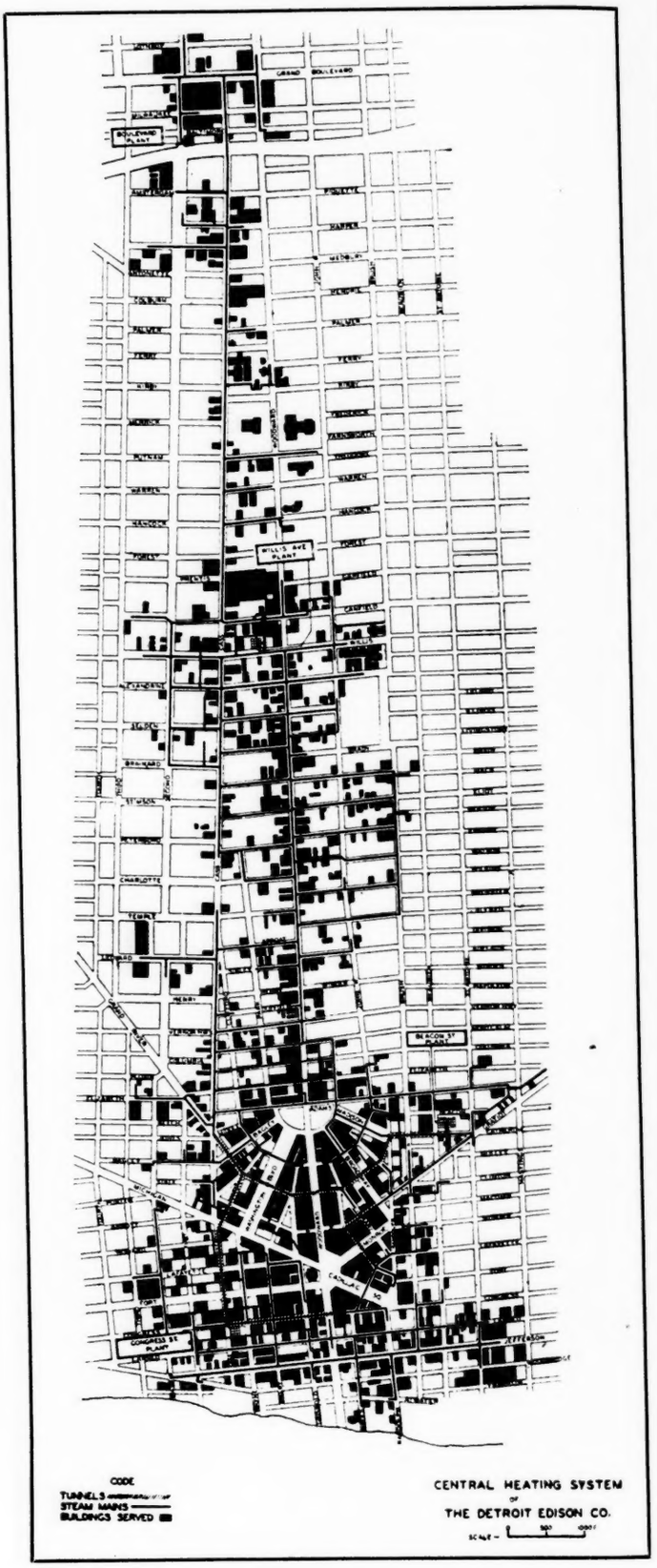


Fig. 1. Map of Detroit Edison district heating system showing buildings served.

ground mains were built. Since that time the system has grown from year to year.

The more important features of the district heating system operated by The Detroit Edison Company in Detroit are discussed in the remainder of this paper.

At the present time, four boiler plants containing a total of 19 boilers supply steam to an area approximately 3½ miles long and from one-half to two miles wide shown in Fig. 1. The distribution system consists of 2½ miles of tunnels and 223,918 ft of mains and feeders. The generation of electricity as a main feature of the heating plant operations was discontinued many years ago although it is still carried on to a limited extent. During 1945, 204,722 tons of coal were burned in the four heating plants and 2,959,000,000 lb of steam were delivered to the 1,634 steam customers. These 1,634 customers include hotels, office buildings, apartment buildings, department stores, factories, restaurants, auto sales rooms, rooming houses and residences, etc.

The engineering of district heating may be divided roughly into three phases: Boiler or heating plants, steam distribution systems, and utilization of the steam heating service by the customer.

Steam Heating Plants

Most of the District Heating companies are owned by or are a part of the electric utility companies serving the areas involved. It is natural, therefore, that the heating plants should follow closely the design of the larger electric generating stations. However, because of the low load factor* under which heating plants must operate, air preheaters, economizers, and other heating saving devices are usually not installed. Heating plants in most cases are located in or near highly congested and high value areas, and smoke and other dirt factors are a nuisance. An hourly graph of the total output of the system on a cold day is shown in Fig. 2.

Three of the four heating plants have double ended boilers, fired by underfeed stokers and are similar to the company's older electric generating stations. At the time the last one of these plants was built, no satisfactory method of removing fly ash from the stack gas had been perfected and the use of pulverized coal was held undesirable.

Since the three largest heating plants are located some distance from railroad sidings or docks, the transportation of coal and ashes is a problem. Coal is prepared at a station either at a dock or at a railroad siding and hauled to the plant by motor truck. The truck bodies are hoisted to the top of the plant by cranes and emptied into the overhead bunkers. Ashes are dropped into dump trucks and hauled away.

Water Treatment

Boiler water treatment has been and continues to be one of the most important engineering features of the heating plants. Inasmuch as it is impractical to return a large part of the condensate from the customers' buildings, three of the plants require from

*Load factor for 12 months 1945 was .272; for 12 months 1944, l.f. was .271.

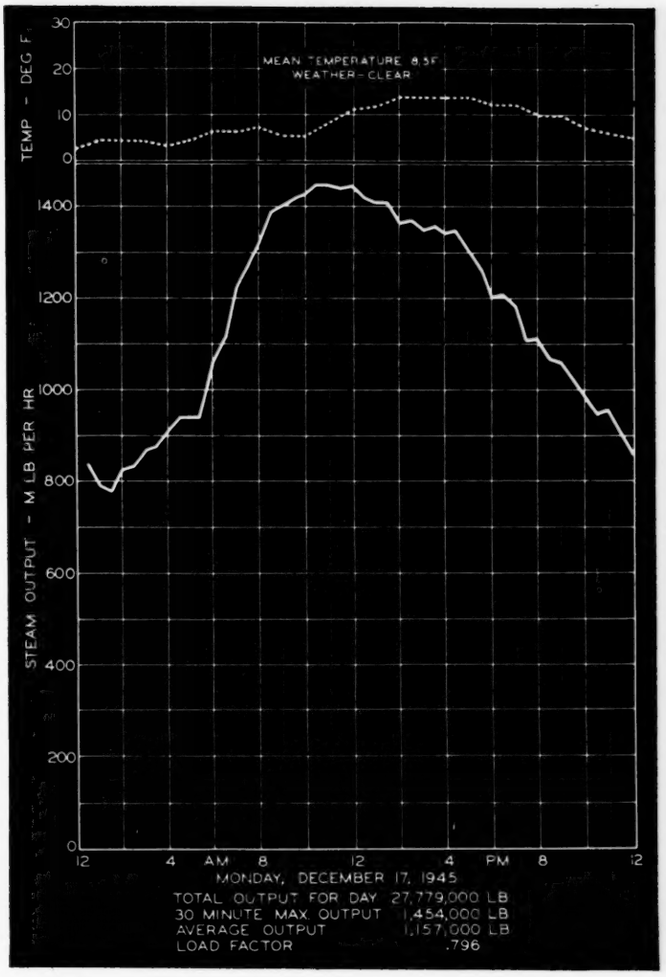


Fig. 2. System output curve for a cold day.

80% to 100% make up water, drawn from city water mains. Detroit city water, while of excellent quality for general use, will cause scale and other troubles unless conditioned for boiler use.

In the early days, soda ash (Na_2CO_3) was used in the effort to prevent the formation of hard scale in the boilers. This practice eliminated anhydrite scale deposits but not the calcite deposits in the boilers. Neither did it limit the CO_2 and oxygen in the steam.

The first steps to improve these conditions were taken in 1926 when zeolite water softeners and partial acid treatment, together with an effective deaerator, were installed in the new Beacon Street Plant. This system was highly successful. The softeners produce water which was practically scale free, and the acid treatment reduced the CO_2 content of the steam to about 10 ppm. The deaerating heater reduced the free oxygen in the steam to about 0.04 ppm.

Inasmuch as the steam continued to contain from 10 to 20 ppm free CO_2, the corrosion problem in the customers' premises persisted. To improve this condition, additional acidification of the zeolite softened water was undertaken. Acid proportioning equipment and operating practices were developed so that alkalinity of the zeolite treated water could be reduced to less than 10 ppm. A more complete acidification was not practical because of the likelihood of acid attack on the pumps, piping, and deaerators. With this water

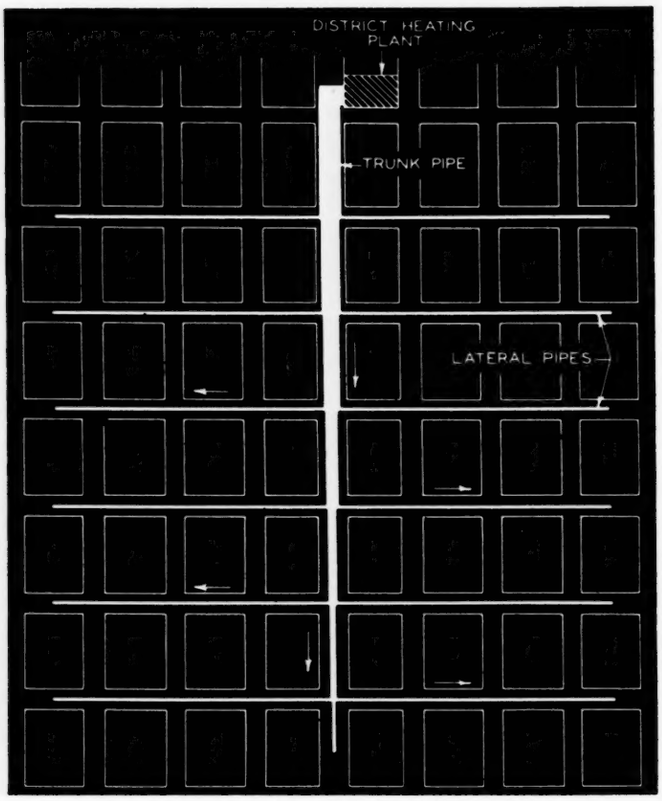


Fig. 3. Trunk main system.

conditioning system, the steam produced contains no free oxygen and from 3 to 5 ppm free CO_2.

A further step in CO_2 elimination is now being undertaken at the Willis Avenue Heating Plant. Here a complete new water heating system is being installed. The use of green sand in the zeolite water softeners will be continued. A stainless steel deaerating heater will be installed and this will permit the complete acidification of the water before its entry into the heater. This will permit the complete liberation of all CO_2 from the boiler feedwater. Caustic will be added to the deaerated water in the storage space of the heater to produce a definitely alkaline boiler feedwater.

Generating of Electricity

In three of the four plants in Detroit, electric generating units are installed through which some of the steam is passed before being distributed to the heating system. The question as to whether or not generation of the electricity system as a by-product is used and desirable cannot be given a fair answer but must be decided in each individual case on the basis of local conditions. The correct answer in any particular case depends upon the value of a kilowatt-hour of electricity at the location of the heating plant as compared with the total cost of producing it in the heating plant. The thermal advantage in passing all of the steam through turbo-generators is recognized. The commercial advantage does not, however, appear to be favorable. We have installed (1) sufficient generating capacity to supply the motor driven auxiliary equipment in the plants using the exhaust steam to heat the feedwater and delivering any excess electricity to the companys' electrical system and (2) some small turbo-generators to deliver electricity solely to the electrical system and to the steam heating mains. These machines are of a size so that they can operate at full capacity during most of the heating season. The commercial advantages of combined electricity and steam production are, of course, more favorable with higher boiler pressures and future practice may be altered.

Steam Distribution Systems

There are two fairly well defined types of steam distribution system, namely, trunk main systems and feeder systems. See Fig. 3 and 4. The trunk main system is built with a rather large pipe leaving the heating plant. Its size is decreased as the distance from the plant becomes greater and the amount of steam to be carried becomes less. Lateral pipes are laid in the intersecting streets forming a more or less interconnected network. Inasmuch as customers are served from either the trunk main or the lateral pipe lines, it is necessary to maintain the steam pressures in all piping within the limits acceptable for customer use. Because steam pressure drops are limited steam velocities must be kept low.

The feeder system of distribution, Fig. 4, consists of a network of distribution steam mains from which the customers are served and feeder mains which extend from the heating plant to selected points in the distribution network. A constant steam pressure is maintained at the point where the feeder connects to the network by regulating at the heating plant, the amount of steam fed into the feeder. The pressure at the remote end of the feeder is recorded at the heating plant by electrically operated long distance pressure gages. The distance over which steam can be trans-

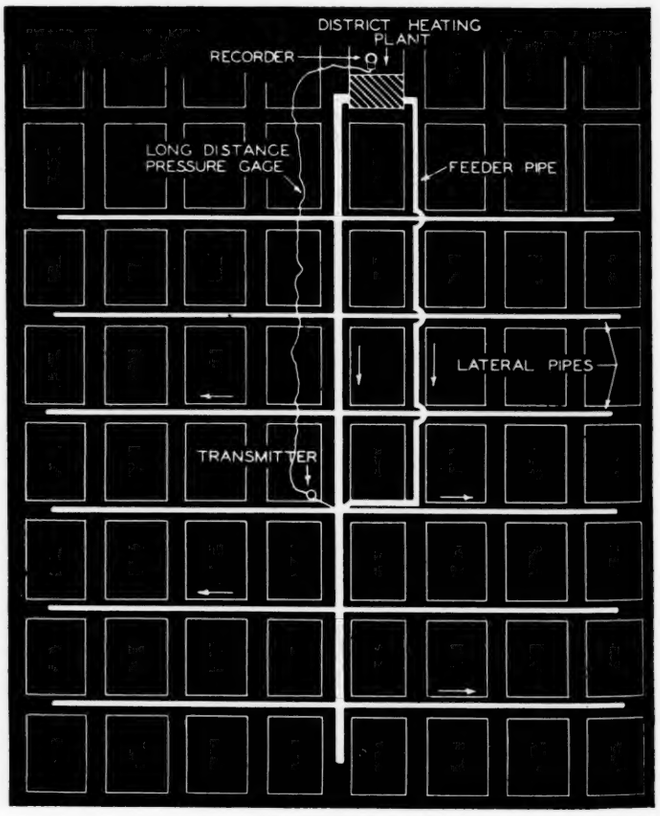


Fig. 4. Feeder system.

mitted has been found to be very great, depending only upon the pressure drop which is available.

The steam distribution system in Detroit is a combination of both trunk and feeder mains. The longest feeder is approximately one and one-half miles but some steam is taken off the feeder through risers somewhat nearer to the heating plant.

Underground Pipe Construction

There are several types of pipe conduit in common use. The wood casing has been widely used and is satisfactory where the soil is well drained. In the larger cities a more permanent form of construction is employed such as concrete, vitrified tile, or some of the prefabricated conduits.

The Detroit Edison Company has standardized on the concrete box type of construction as shown in

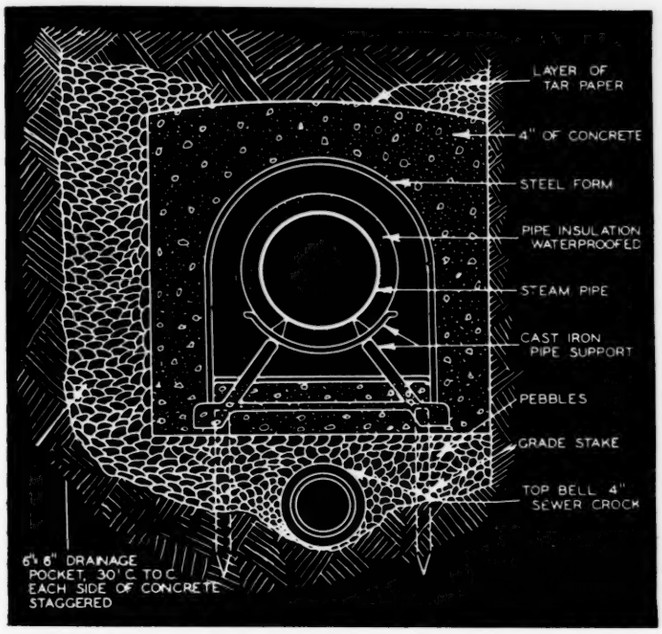


Fig. 5. Cross section of underground steam main conduit.

Fig. 5. This design is waterproof enough for the purpose and is easily adapted to special conditions met with in the city streets.

Excavation costs are a major portion in the cost of underground steam main construction. It is desirable, therefore, to keep the excavation depth at a minimum, making the necessary elevation breaks in the line to keep near the surface. The approximate cost of underground line construction at the present date is

Normal Pipe Size, Inches	Approximate Cost per foot, Dollars
6	25
8	26
10	32
12	40
16	47

The concrete envelope construction now in use dates back as far as 1909. However, the life of any buried construction depends greatly upon the soil conditions, and Detroit cannot necessarily be a criterion.

The distribution system contains about 2½ miles of horseshoe shaped tunnels, some of them being as deep

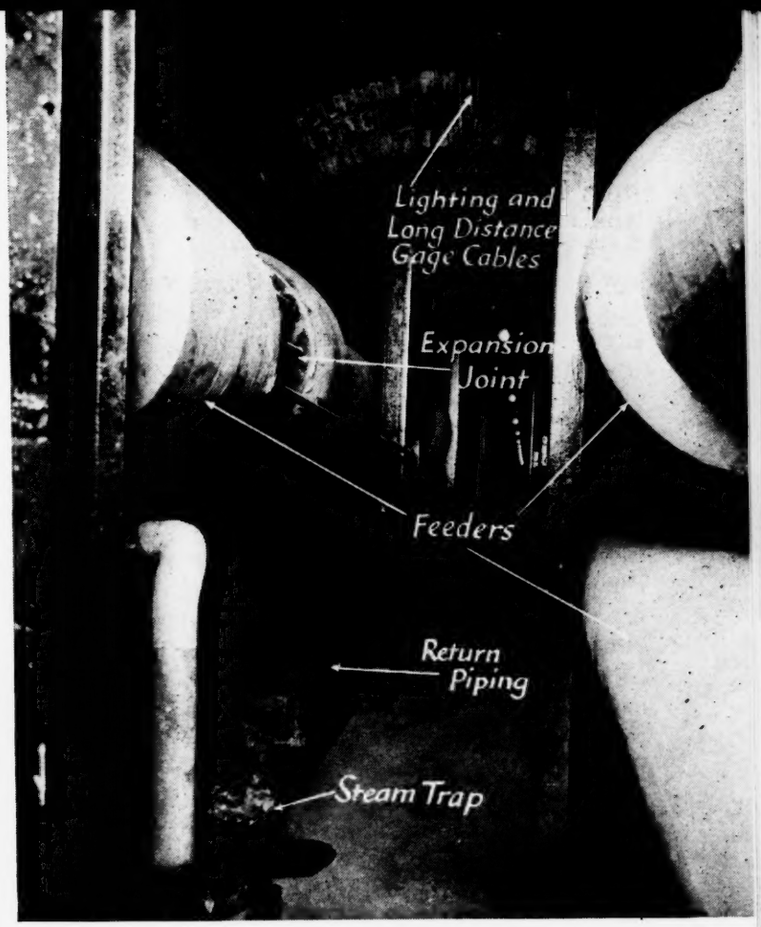


Fig. 6. Section of Beacon-Woodward tunnel showing three feeders and return piping.

as 60 feet, others just under the pavement. It is necessary to ventilate the tunnels by suction fans and when work is to be done in the tunnels, the nearest manhole cover is opened so that the amount of ventilation in the immediate area is increased. The tunnels are all equipped with telephone and lighting systems. It is particularly desirable to have tunnels in congested downtown districts where it is necessary to install two or more pipes in the same street since it is unnecessary to tear up the street either for the original installation or any necessary repairs. A section of the Beacon-Woodward tunnel in Detroit is shown in Fig. 6.

Pipe lines to carry the condensed steam from the customers' premises are costly to install and are expensive to maintain because of the severe oxygen corrosion. Their installation in connection with buried steam mains, therefore, cannot be justified in Detroit. The condensate from most customers is discharged into the sewers, except in a few special cases.

In the tunnels, it is necessary to install condensate lines to handle the drips from the steam mains. Since the tunnels are mostly below the sewer lines, the condensate lines are carried to shafts at the heating plants. The condensate from some of the buildings adjacent to the tunnels is discharged into the tunnel condensate lines and returned to the plant. The total amount of condensate returned from all sources is 16% of the steam delivered to the distribution system. This small amount of returned condensate is responsible for the large amount of make up water needed by the boilers and water treating systems.

Much time and money have been spent to develop to a high degree the efficiencies of both utility and isolated heating plants. The matter of increasing the efficiency of a plant by a fraction of one percent is

considered important. Very little may be gained, however, if after developing the efficiency of the steam producing plant to such a high degree, the steam is used in the building heating systems in a wasteful manner. Unfortunately, a very large part of the existing buildings of this country do not follow truly economical practices in their heating operations. The difficulty lies in old and poorly designed heating systems, which cannot be operated in an economical manner without extensive alterations, the lack of suitable instruments and automatic control equipment, and poor operating practices.

The district heating business in Detroit exists under highly competitive conditions. It is important from a commercial standpoint, therefore, to have a program of assisting the customers to obtain the maximum results from the steam they purchase. To accomplish this, a staff of engineers is maintained to instruct the customers in the use of their present equipment and to advise them of changes which will reduce the amount of steam required, and to cooperate with architects and engineers in the design of heating systems for new buildings. Results of the work of this staff can be seen in Fig. 7.

The utilization program is conducted on a rather broad scale. The factors influencing the amount of steam used for heating are:

(a) The number of degree days for the area in which a building is located.
(b) The size of volume of a building and the type of construction.
(c) Hours of occupancy requiring heat.
(d) Occupancy or use.
(e) Type, design, and condition of heating system.
(f) Kind of building temperature control.
(g) Efficiency of the operating personnel.

For any given building there is very little that can be done about the first and second items. Proper consideration of the remaining items, however, usually results in important savings in steam consumption.

Hours of Occupancy Requiring Heat

A careful study usually reveals that for several or perhaps many hours of each day, any building is unoccupied except for a watchman. Commercial buildings are usually unoccupied during week-ends and holidays, while other classes of buildings, such as churches and auditoriums may be occupied only at odd hours.

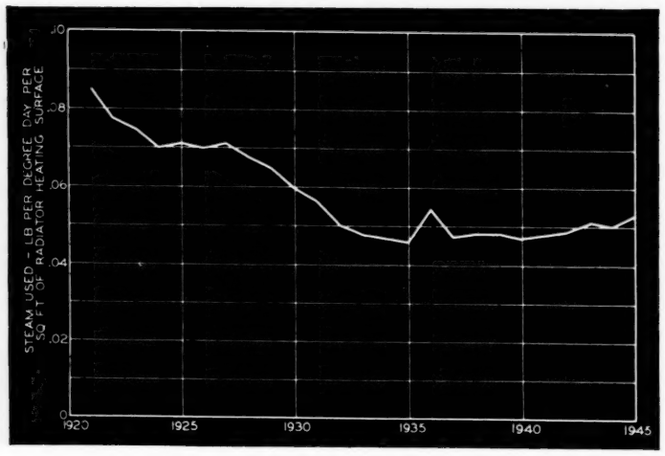


Fig. 7. Effect of educational work with customers on steam consumption.

Studies and experiments have demonstrated that one of the most fruitful methods of conserving heat is to shut off the heating system completely during the non-occupied periods except as may be necessary to prevent freezing. In general, it has been found that building temperatures drop slowly after the heating system is shut off and no steam is required at night except in extremely cold weather.

The results which are produced by night shutoff in one building are shown by Fig. 8. This building is used chiefly for offices which may be occupied until 8 p. m. and has a conventional two pipe vacuum return heating system. A complete three zone temperature control with time clocks which provide automatic night and week-end shut-off is installed. During a 24-hour period when the control operated in normal manner, 55,650 lb of steam were used. The small amount of steam used during the period when the main heating system was shut off was required for heating the lobby and first floor stores. When the control operated to maintain a temperature of approximately 75F throughout the 24 hour period, 66,450 lb of steam were used.

It is probable that night shutoffs may not be as effective in all cases, but we have proven that worthwhile economies are accomplished, even where the steam can be shut off for only a few hours each day. Separate steam supply lines to those portions of the building which require long hour heating pay for themselves in a very short time.

It is important to emphasize that night shutoffs can be practiced without interfering in any way with the comfort of the building occupants. The steam is turned on sufficiently early so that the temperature becomes normal before the occupants arrive, or in residences before they normally arise.

In tests in an office building, it was found that for a 30F outside temperature the inside temperature dropped from 73F to 60F in 11 hours.

It is reasonably well understood that the temperature to which a building should be heated depends upon its type of occupancy or use. Residential quarters, offices, banks, and other similar types of occupancy require a temperature near 75F to assure comfort to the occupants. For commercial buildings, warehouses, lofts, and light manufacturing space, somewhat lower temperatures are adequate. There is a general tendency to overheat nearly all buildings.

Type, Design, and Condition of Heating System

It cannot be said definitely that any one type of building heating system is definitely superior to all other types. For example, in a small building a simple one pipe heating system if properly operated may give as satisfactory results as a more complicated system. In the larger buildings, heated by direct radiation, the high vacuum systems seem to produce the most economical results, because the steam piping and radiators are maintained at low temperatures and there is less possibility of overheating.

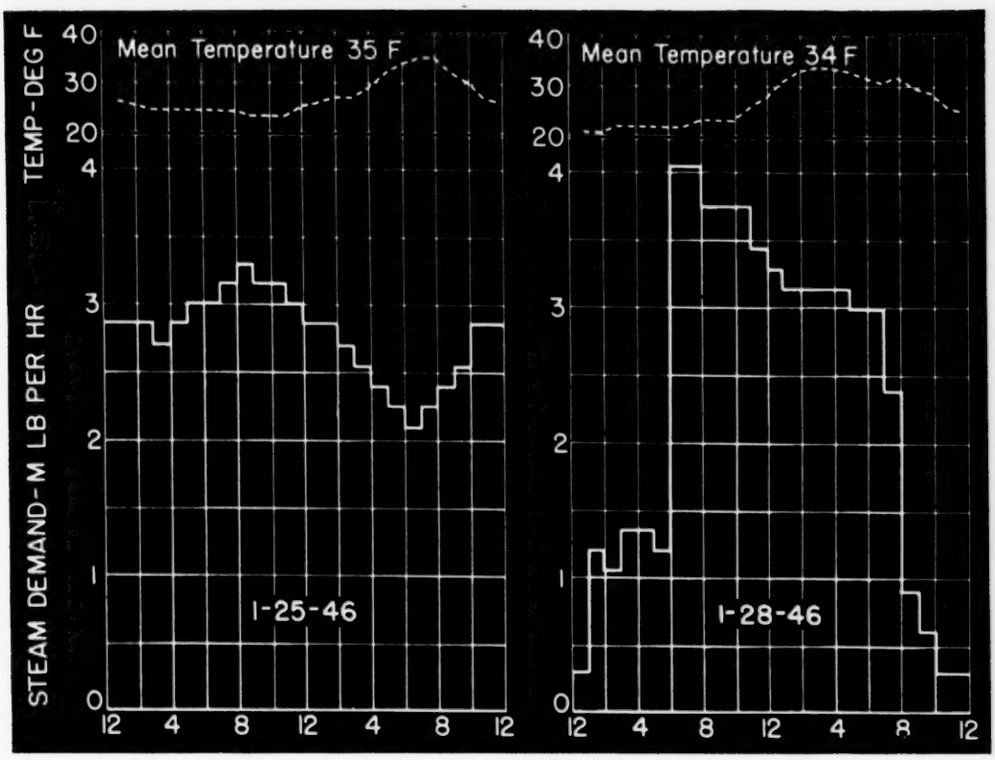


Fig. 8. Consumption curves for office building showing savings by shutting off at night. Jan. 25, steam consumption (without night shutoff) 66,450 lb, average wind velocity 15.8 mph; Jan. 28, steam consumption (with shutoff) 55,650 lb, average wind velocity 18.1 mph. Heated space, 1,338,320 cu ft; radiator surface, 21,405 sq ft.

In most cases where heating is accomplished by the circulation of heated air the economy is good, provided proper consideration is given to recirculation.

The most important point with respect to any heating system is the way that it is designed, installed and maintained. No heating system can operate efficiently unless it will heat the entire building uniformly and will respond rapidly to the changing conditions imposed upon it by outdoor temperature fluctuations. Steam pipe sizes must be adequate and the pipe lines must be properly pitched and drained. Radiators must be of the proper size and neither too large nor too small.

Return lines must be pitched and vented where necessary to avoid air pockets which will make parts of the heating system inoperative. These and many other small details of design and installation can greatly reduce the effectiveness of any heating system.

One of the important major considerations in the design of a building heating system is the zoning and segregation of various parts of the systems where the heating requirements may be dissimilar. Thus it is unusually desirable to provide two or more zones for parts of the building where heating requirements may be different due to exposure or other reasons. In nearly every building, separate steam supply lines to shops having long hour heating are desirable.

In very tall buildings, the stack effect must be considered in designing the heating system. Heated air attempts to rise to the tops of these buildings and to offset this, the openings between floors should be reduced to a minimum and elevator shafts should be enclosed. (1) Despite these efforts to minimize the stack effect, there are instances on record where it was necessary to increase the amount of radiator surface for the first few floors of tall buildings as much as 40% in order to produce comfortable conditions.

Poor maintenance practices can destroy the effectiveness of any heating system. A single radiator trap which permits steam to blow through will interfere with the operation of all radiators in the immediate vicinity. Plugged drip traps may prevent the heating of radiators in whole sections of the buildings. Leaking valves permit the entry of large quantities of air into the system. This aggravates the corrosion problem, contributes to the fouling of traps and prevents the carrying of the high vacuum depended upon for efficient operation.

One of the most common sources of waste is the overheating of buildings and much of the work involving the economical use of steam is in connection with building temperature controls. The experience of the Detroit Edison Company indicates that from 10% to 25% can be expected as a savings by the installation of control equipment in the average building without any reduction in the comfort of the occupants. In many cases, the overall comfort of the building is improved by the installation of the temperature control.

Before temperature control apparatus of any type is installed, a survey of the heating system involved should be made to determine if the system is in good condition, has good circulation, and is balanced. If it is necessary to carry high steam pressures in cold weather, or portions of the building are consistently underheated, the systeam undoubtedly is unbalanced.

There are many types of temperature control system ranging from simple thermostats to automatic cycle controls and high vacuum and differential pressure control systems. The simple thermostat systems cost the least while the high vacuum and pressure differential systems are the most expensive to install. The cost of the control must be balanced against the savings in steam consumption which can rearsonably be expected. Small jobs therefore usually are outfitted with simple thermostats and perhaps a time clock for night and week-end shutoff. The larger building may be equipped

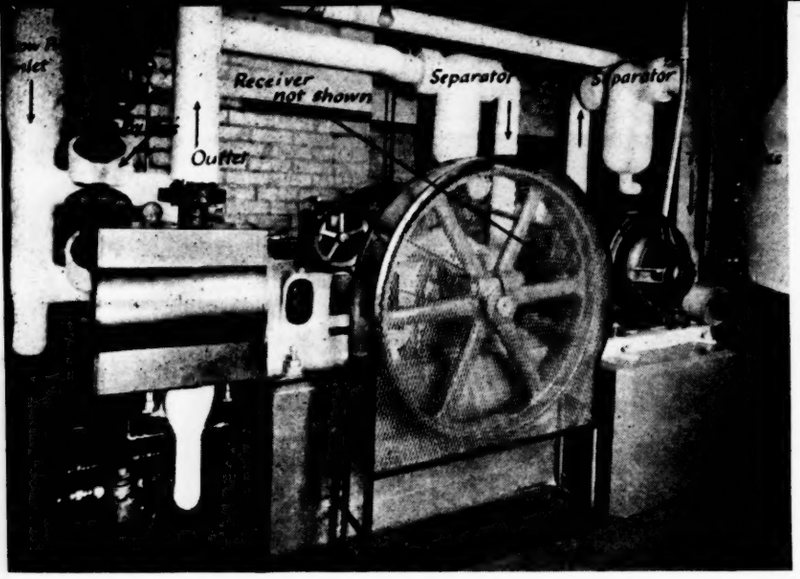


Fig. 9. One of two steam compressors in a department store.

with the more comprehensive control system.

Radiator orifices are frequently used in connection with the control of two pipe radiator heating systems. The orifices, which may be discs through which a hole of the proper size has been drilled, are installed at the inlet of each radiator. They provide a simple and inexpensive means of correcting certain conditions of unbalance in the system. They are not, however, a cure-all.

With orifices in the radiators, the entire supply line fills with steam rapidly and the radiators at the end of the system are supplied with steam at approximately the same time as those close to the source of supply. If radiators are oversized, the orifices will tend to prevent overheating in that particular section. However, orifices will not increase the heating capacity of radiators and if any section of a building has insufficient radiation, additional radiators or larger radiators should be installed. Table 1 shows orifice sizes for different size radiators.

Table 1 — Orifice Sizes

Radiator size, Square Feet	Size of Orifices, 64th of an inch
15-19	7
19-25	8
25-30	9
30-37	10
37-44	11
44-51	12
51-59	13
59-67	14
67-76	15

These orifices are designed to fill the radiator with steam at a pressure differential of 4 in. Hg.

In general, the heating systems have performed acceptably but a considerable number of operating difficulties have been encountered. Some of these difficulties are caused by shortcomings of the heating systems rather than by the control system. Others have been caused by mechanical defects of the control equipment. The majority of difficulties, however, are caused by the failure of the building operators to understand and appreciate the equipment itself. This is largely a matter of education and can be corrected only by continual effort on the part of the Company and the control equipment manufacturers.

The efficiency of the building operating personnel frequently has more influence on the economical use of steam than any single item. Improvement of operating personnel is largely a matter of education of the building management as well as their operating staff. In many cases, the building management, in an effort to minimize labor costs, employs unskilled labor to operate and maintain their mechanical equipment. Under these circumstances, waste is inevitable. Those charged with the actual operation of heating systems using purchased steam are usually quite cooperative. They appreciate greatly the absence of boilers, coal, and ashes and their accompanying drudgery. Those who have the ability to learn, become accustomed to modern heating and control equipment. They appreciate the importance of reducing steam consumption and work diligently toward this end. Some operators, unfortunately, do not have the capacity required to understand economical heating practices. Good heating results, therefore, are difficult to attain.

Steam Compressors

Although a nominal supply pressure of 30 lb is sufficient for nearly every requirement of a customer, there are a few users for which a higher pressure (50 to 75 lb) is desirable, such as in some clothes pressing machines and certain laundry apparatus which has been designed for pressures higher than 30 lb and where a higher temperature is helpful. These uses require only small quantities of steam. The cost of installing a parallel network of high pressure mains to supply these small amounts of steam would be very high when compared to the steam revenue available. An alternative expedient has been developed. The customer installed a compressor, driven by an electric motor, which takes steam at the supply pressure and compresses it to the pressure desired. The compressors are ordinary reciprocating air compressors, modified in certain details as shown in Fig. 9. The power required to compress steam from 30 to 75 lb per sq in. is about 32 kwhr per thousand pounds of steam.

Conclusion

The engineering features of the district heating industry as it concerns steam generating plants will probably continue to follow along the lines of the large electric generating plants. As coal prices increase more heat saving devices, such as air preheaters and economizers, may be justified.

There will undoubtedly be more combinations in which electric plants will deliver steam to steam distribution systems.

New materials, particularly new insulation and metals, will be factors in the improvement of the steam main conduits.

Customers' economical use of the service will be improved through wider use of control equipment and the appreciation of good heating service.

The steam heating service has been well accepted by the company's customers, 90% of the available business is served, and as the city grows there will be a corresponding growth in the heating utility.

Serving a Large Detroit Hotel with Purchased Steam

C. B. SPRENGER

Engineer, The Detroit Edison Co.

Changes necessary to convert a large hotel from the use of steam from its own plant to purchased steam.

THE Wardell-Sheraton, a 12-story apartment hotel, located in the Art Centre district of Detroit, was erected in 1926. At that time three 120 hp locomotive type boilers, designed for operation at 100 lb per sq in. to supply steam for space heating and for process work in the kitchen, laundry, and valet shop were installed. These boilers were oil fired until 1927 when underfeed stokers were installed.

In the spring of 1945, after carefully weighing all the factors, the hotel management decided that it would be more economical to purchase its heating services than to continue use of its own boiler plant, and a contract was signed with The Detroit Edison Company. The service was installed during the summer of 1945 and operated in a highly successful manner during the past heating season. To serve this building it was necessary for The Detroit Edison Company to extend its underground steam distribution system by 343 ft of 12-in. main. An 8-in. service line was installed from this new main to the hotel basement to supply the estimated maximum hourly load of 11,500 lb of steam per hour.

Changes within the hotel were laid out by the hotel engineers in cooperation with the author. They included the zoning of the space heating system, installation of suitable heating controls, the rearrangement of the process heating steam mains, the replacement of steam driven mechanical equipment with motor driven units, and the installation of a motor driven steam compressor to furnish 90 lb per sq in. steam for some of the laundry equipment. Bids were taken and a contract let for all changes within the hotel.

The contractor's first work was to install an 8-in. steam main from The Detroit Edison steam service valve, which was located just inside the west wall of the basement, to the engine room on the east side of the building. This main is 160 ft long and is supported by brackets on the columns and hangers fastened to the concrete beams. Provisions had to be made for the expansion of this main together with the expansion of 30 ft of The Detroit Edison Company service pipe. A slip type expansion joint was installed about 48 ft from the extreme end of the main which was anchored to a column. The expansion joint was set at a column with guides around the pipe to prevent buckling.

There are seven connections taken off this main—five to supply the various zones of the heating system and two to supply the process steam. Zones for the heating system are: (1) Direct radiation on floors 2 to 12 inclusive; (2) Ventilating system for first floor; (3) Direct radiation first floor; (4) Cocktail lounge; (5) Garage. The process mains are a 2-in. branch to the kitchen and a 4-in. branch to the steam compressor and water heaters in the engine room.

The entire heating system and the water heaters were formerly supplied with steam from a low pressure header. This was connected to the high pressure boiler header by two pressure reducing stations. A pressure of 2 to 5 lb per sq in. was maintained on the low pressure header.

The main heating system, floors 2 to 12 inclusive, is a two-pipe down feed vacuum system with thermostatic radiator traps. The distributing header is in the pipe space above the twelfth floor and the risers end in the space between the first and second floors, being bled by ½-in. thermostatic traps. This system was controlled by a manually operated gate valve.

This system is now supplied with steam through an 8-in. pressure reducing valve and motor valve from the new main connecting direct to the main riser.

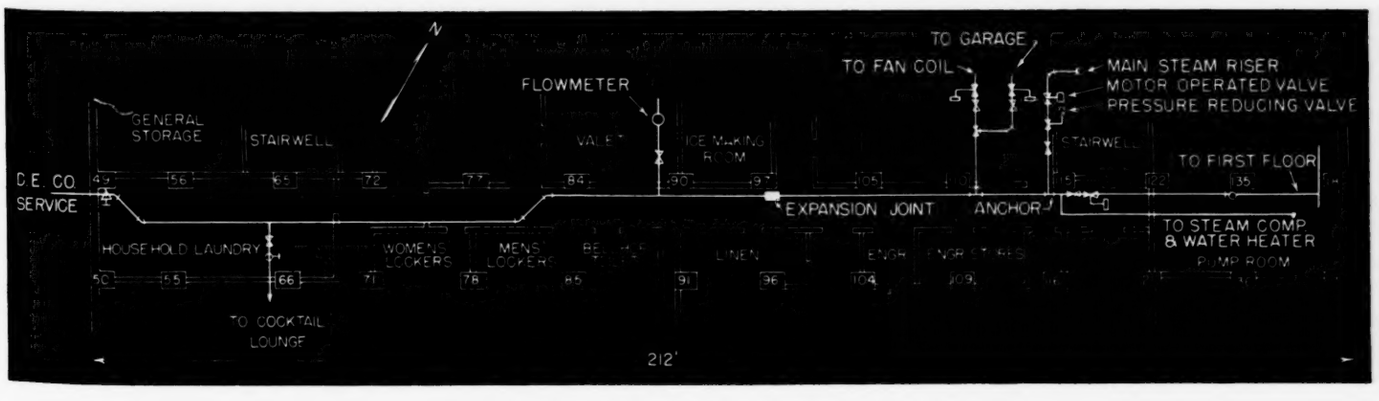


Fig. 1. Steam line from Detroit Edison supply to hotel outlets.

The motor valve is operated by a control which varies the differential pressure across the radiator according to the outdoor temperature. By orificing each radiator, the amount of heat emitted by it is proportioned according to the heat loss of the building. The size of each radiator orifice was determined by calculating the heat loss of the room it supplied.

The first floor of the building is used for lobby, offices, dining rooms, kitchen, and several shops. This has a split heating system, part of the heat being furnished by the direct radiation and part by fan coils. The fan is operated for ventilation and on cold days is used as an additional source of heat for this floor. The heating coils were supplied through a separate 4-in. pressure reducing valve and are equipped with pneumatic temperature controls.

The direct radiation is supplied through a separate 2-in. pressure reducing valve and a motor valve. The motor valve is operated by a control which consists of a timer or cycler and an outdoor bulb. The latter determines the length of time the steam is on and off during each cycle of operation. A differential pressure control is also wired in the motor valve circuit so that the differential between the supply and return is 6 in. of Hg or 3 lb per sq in.

The Sapphire Room or cocktail lounge, occupying one of the stores on the first floor, is air conditioned with a unit conditioner. Steam is supplied through a separate 1¼-in. pressure reducing valve to the heating coil and is controlled by an electric modulating type motor valve. The controlling thermostat is located in the room.

The garage, which is a separate two-story building in the rear of the main structure, is heated by unit heaters. A separate connection with a 2-in. pressure reducing valve and motorized valve was installed to supply the garage heating system. The motor valve is controlled by a time switch in the engineer's office.

The process steam, except the high pressure for the laundry, is supplied through a 2-in. branch steam main direct to the kitchen. Steam flow through this branch main is metered by a 2-in. shunt type flow meter. It was decided to use a flow meter on this section as a large part of the equipment served, such as vegetable steamers, proof ovens, garbage can sterilizers, dishwashers, use steam directly. In order to meter all open end steam service, the valet shop and the starch kettle and two washers in the laundry also are served from this kitchen branch main.

A 4-in. branch main off the end of the new steam main extends into the engine room. This branch main supplies the four domestic water heaters through a 2½-in. pressure reducing valve and also the steam compressor.

A steam compressor was necessary because the laundry equipment, such as flat work ironer, tumbler dryer, and shirt presses, is designed for use with steam at 90 lb per sq in. and does not operate at full efficiency at lower pressures. A 9-in. x 9-in. compressor rated at 934 lb of steam per hour compressing from 25 to 90 lb per sq in. was installed. This compressor is driven by a 40 hp motor.

The compressed steam passes through a separator and then a small storage tank. The pressure is regulated by an unloading device which lifts the intake valves when the pressure reaches 100 lb per sq in. During this unloading period the motor is overcoming only the friction loss of the machine.

Some of the laundry equipment, presses, etc., and the elevator door operators require compressed air. This air was being supplied by a steam driven vertical compressor. A new 6-in. x 7-in. air compressor complete with after cooler and storage tank was installed to replace this unit.

Existing steam driven vacuum pumps were removed and a new electric driven duplex vacuum pump set in their place. These pumps handle all returns from direct radiation and discharge the condensate to a surge tank. All the other returns from the laundry, water heaters, and garage flow into the surge tank by gravity. This tank is vented to the room and discharges through an economizer to the condensate meter.

The economizer is a 500 gal storage type unit, with 200 sq ft of heating surface in the form of copper U-tubes. All the domestic hot water flows through the economizer, before entering the heaters, which removes most of the heat left in the condensate. The temperature of the condensate entering the meter is between 80 and 90F.

There were a number of heating complaints the first few months due to faults in the heating system. Several of the thermostatic drip traps at the bottom of the supply risers were found plugged with dirt, and as a result these risers were slow to heat since the last radiators were forced to take the condensation cutting off their steam supply. These traps are now being replaced with combination thermostatic and float traps.

A short circuit in the wiring of the control for the main heating system caused erratic operation of this control. A new electric cable remedied this situation.

To date the amount of steam actually used is less than estimated by about 5.1% after correcting the estimate for the actual temperature. This, of course, is an additional saving to the management.

The estimate for heating was based on the calculated heat loss of the building for eighteen hours per day. The estimate for process was based on constants (pounds of steam per cu ft of space) gained by years of experience with various types of buildings and process work.

The amount of steam being compressed for laundry use is well below the actual capacity of the compressor but this is due to the fact that the compressor size was based on future demands. If the hotel business changes from largely permanent residents to 100% transient, the amount of linen will increase and the demand for compressed steam will increase in proportion. At present the amount of compressed steam required is 1.42 lb per piece of laundry dried and the amount of low pressure steam required for washing is about 2 lb per piece.

After one full year's operation, the equipment installed is operating in a most satisfactory manner. Steam consumption for both heating and process is below the estimate due to the excellent cooperation of the engineering staff of the hotel.

High Pressure Condensate Drainage for Foundry Heating

J. P. TURNER
Cochrane Corp., Philadelphia, Pa.

PARTICULARLY in foundries where air must be completely changed in less than five minutes to exhaust the fumes, modern tendencies are toward higher steam heating pressures of around 75 to 125 lb per sq in. The advantages of the higher pressures are due to the higher heat content of the steam. For instance, steam temperature at normal 5 lb per sq in. heating pressure is 228F, while 100-lb steam temperature is 338F.

In one modern foundry eighty blast heaters operate at 75 lb per sq in. Because of the large buildings involved and the long condensate lines, gravity drainage from the trapped heaters has proved impracticable. Heaters become water-bound, water hammer develops, and at low winter temperatures, the rapid inflow of sub-freezing outside air causes freezing of the accumulated condensate and consequent rupture of heating coils. As an example of the size of such a heating load, the condensate removal from the heaters is 240 gpm at the desired air temperature rise from 0F to 50F. Smoke and fumes are exhausted through overhead fans and the air is changed every five minutes.

A solution to the problem of positive high-pressure condensate drainage is a forced circulation pump capable of handling the condensate, entrained air, and occasionally steam vapor itself. In the Cochrane C-B System a specially designed centrifugal pump draws water from its thermo-fin priming loop and discharges it as a high velocity jet through the jet pump nozzle.

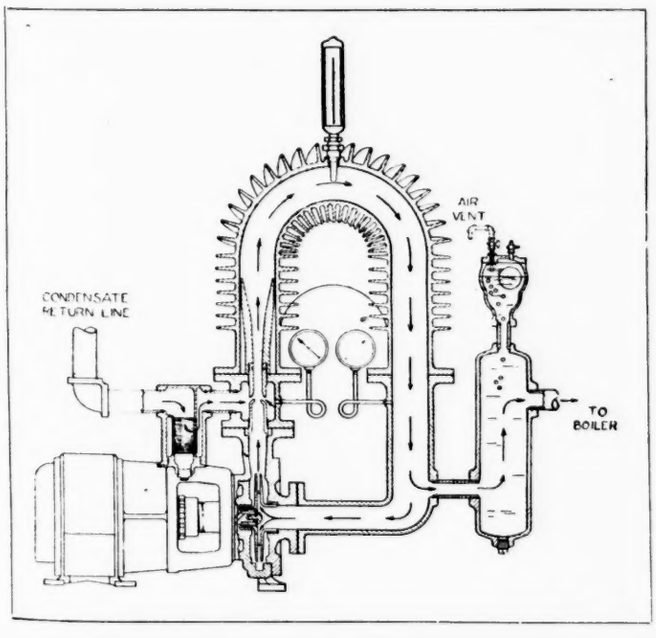


Fig. 1. Diagram showing flow of condensate through high pressure condensate return pump.

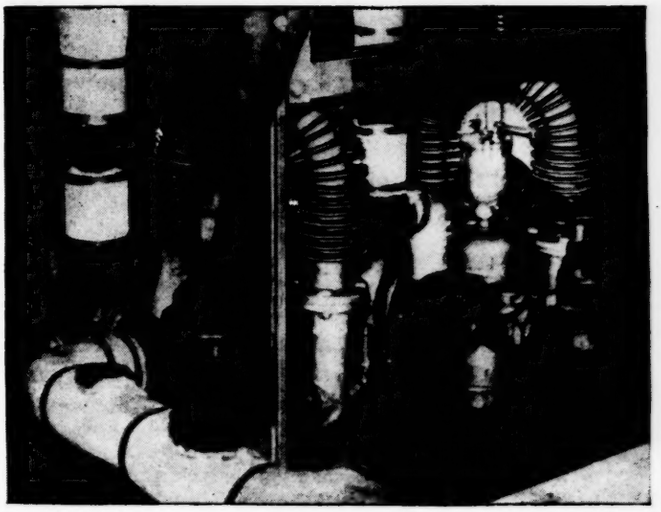


Fig. 2. Two C-B high pressure condensate return units installed in 1941. Vertical lagged lines carry condensate from heating coils. Condensate is pumped into the boilers through the horizontal line in the foreground.

This jet strikes the returned hot condensate and induces condensate flow through the venturi-shaped mixing tube and into the thermo-fin priming loop. This additional volume of condensate introduced into the constantly filled loop results in the discharge of an equal volume of high temperature feed through the air separator to the boiler.

An added advantage is the saving of feedwater and fuel. Condensate removed from high pressure unit heaters at 75 lb per sq in. and stored in a vented receiver at atmospheric pressure results in the loss of 12% of the condensate—29 gpm or 13,920 lb per hr at a 240 gpm heating load—as wasted flash steam. In addition the latent heat of the remaining condensate is wasted.

The 240 gpm of heating condensate provide 115,200 lb per hr hot boiler feed approaching 320F. This amounts to a saving of 110 Btu per lb over the use of condensate at 212F. This amounts to a total saving of 12,700,000 Btu per hr. Assuming $5 coal with 14,000 Btu per lb burned at 75% efficiency, the fuel saving is $2.27 per hr, $54.50 for a 24-hour day, and $1,635 for a 30-day cold-weather month.

A similar heating application has been made in a Michigan plant where a 125 lb per sq in. heating system extending over 13 buildings is drained by this type system. A trailer manufacturer maintains a paint and enamel drying room at 72F by means of high pressure steam-heated coils drained by C-B systems. Besides the increased production rate there was improved quality of the finishes.

Avoiding Wet Walls in High Humidity Industrial Plants

GEORGE R. MORGAN

The author shows how, with relatively simple calculations, the heat and dew point gradients can be plotted for wall and roof constructions to determine whether wet walls can be expected and how the construction can be modified to avoid trouble from condensation of moisture on inside walls.

"LISTEN, MR. ENGINEER," said the executive of a manufacturing company, "we purchased the old mill over the river and are now manufacturing our product there. Our process requires that a high relative humidity be constantly maintained but we are having trouble and I need your advice.

"All during the winter months the interior surface of the walls stay wet, so much so that at times the water runs down the walls and onto the floor. What causes this condition and how can it be eliminated?"

"Mr. Executive," answers the engineer, "the air conditions in that building are such that its dew point is higher than the wall surface temperature, hence moisture will condense out of the air onto the wall. The indoor temperature is kept at 80F and the relative humidity at 70%, so I am informed. The wall you mention is of brick and is 12½ in. thick, and with an outdoor temperature today of 10F the wall will just naturally be wet."

The foregoing is typical of a situation frequently encountered, and the engineer has a hard time trying to convince the executive that engineers cannot control the laws of physics, and it is these same laws that are responsible—and not something the engineer has done or has not done—for wet walls.

Wet walls are the result of a simple physical fact: the interior surface temperature of the wall is lower than the dew point temperature of the interior air.

Examine Fig. 1, which shows the characteristics of a 12½-in. select hard common brick wall. From the indoor temperature of 80F at the bottom of the chart, project vertically to the slanting line marked 10F outdoor temperature, thence horizontally to the left, and note that the wall surface temperature is 66.6F. From the same indoor temperature project upward vertically to the intersection of the 70% relative humidity slanting line, thence horizontally to the left, and note that the dew point temperature is 69.3F. Therefore, since the dew point temperature is greater than the wall surface temperature, by the laws of physics moisture in the room air will condense into water on the wall for the conditions stated.

Just what can the engineer do to help his executive friend eliminate the wet wall trouble he is now having? He can't control the weather and he can't change the laws of physics, so there are two things left for him to do.

First he can try to get the interior air conditions changed so that the dew point is lower than the wall surface temperature. However, the air conditions of the room have been selected to give the best conditions for manufacturing in this mill and perhaps cannot be changed without affecting production.

Therefore the only thing left for the engineer to recommend is to change the wall construction so as to raise its interior surface temperature above that of the dew point temperature of the room.

He might suggest to his executive friend that the wall be made 16¾ in. thick by the addition of another course of brick either on the inside or the outside of the wall. Fig. 2 indicates what might be expected.

For the conditions mentioned, Fig. 2 shows the indoor wall surface temperature and the dew point temperature to be equal, hence there will still be some condensation on the wall. Therefore the wall must be made still thicker by additional brick courses, or it can be insulated so as to accomplish the desired results.

Fig. 3 shows the original wall with 2 in. thick insulation added to its exterior and an additional course of brick added outside the insulation, which protects the insulation from mechanical injury and from outside weather. It also results in a pleasing exterior appearance of the wall. Use of Fig. 3 indicates that the indoor wall surface temperature is well above the indoor dew point, hence there will be no moisture condensation on the wall.

Fig. 4 is a dew point chart for a typical roof construction.

It will be shown later just how the dry bulb temperature and the dew point temperature will vary through a wall or roof, together with the method of calculating these values.

But first let's review the theory of heat transfer through a wall, or roof. Heat flows through a substance from the high temperature level to the low temperature level, and the rate of flow and the temperature gradient is dependent upon the difference between the temperature levels, and the heat resistance characteristic of the substance. This heat flow is analogous to the flow of electricity, covered by Ohm's law. Ohm's law states that: $\text{Current} = \frac{\text{Voltage}}{\text{Resistance}}$. For heat flow the law may be written:

$$\text{Heat Flow} = \frac{\text{Temperature Difference}}{\text{(Wall) Resistance}}$$

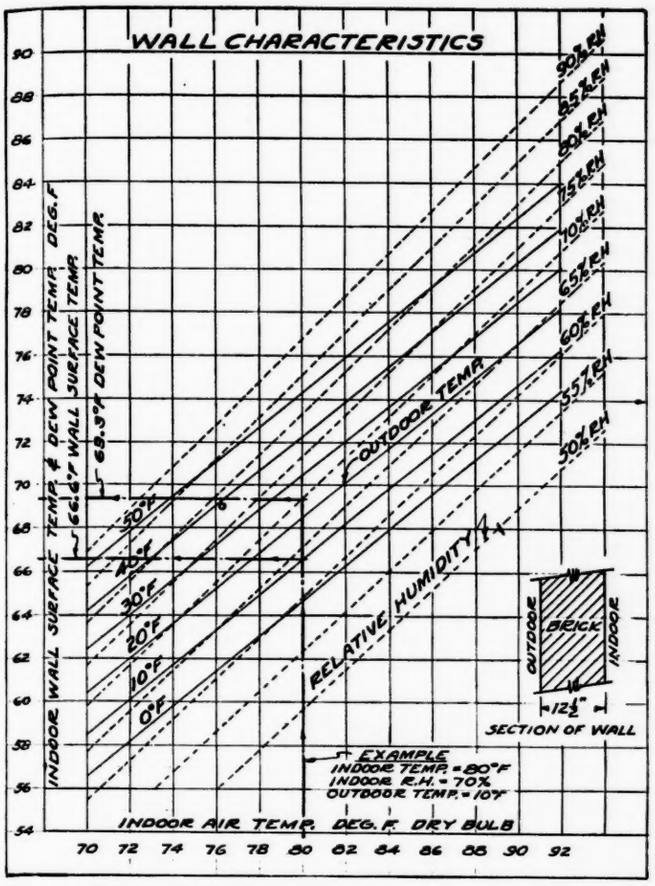


Fig. 1. Graph for determining dew point of inside of 12½ inch brick wall under various temperature and humidity conditions.

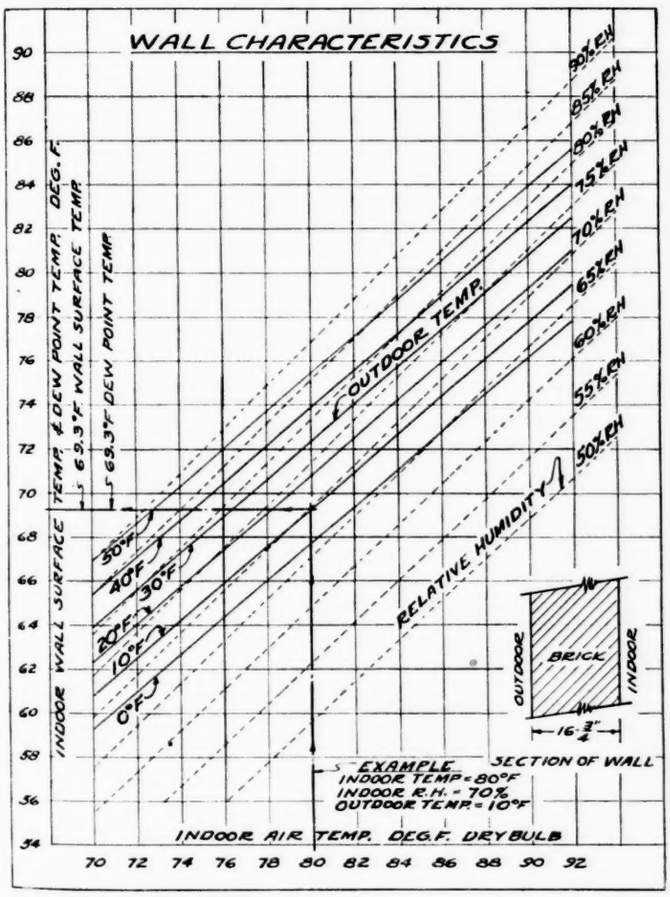


Fig. 2. Graph for determining dew point of inside of 16¾ inch brick wall under various temperature and humidity conditions.

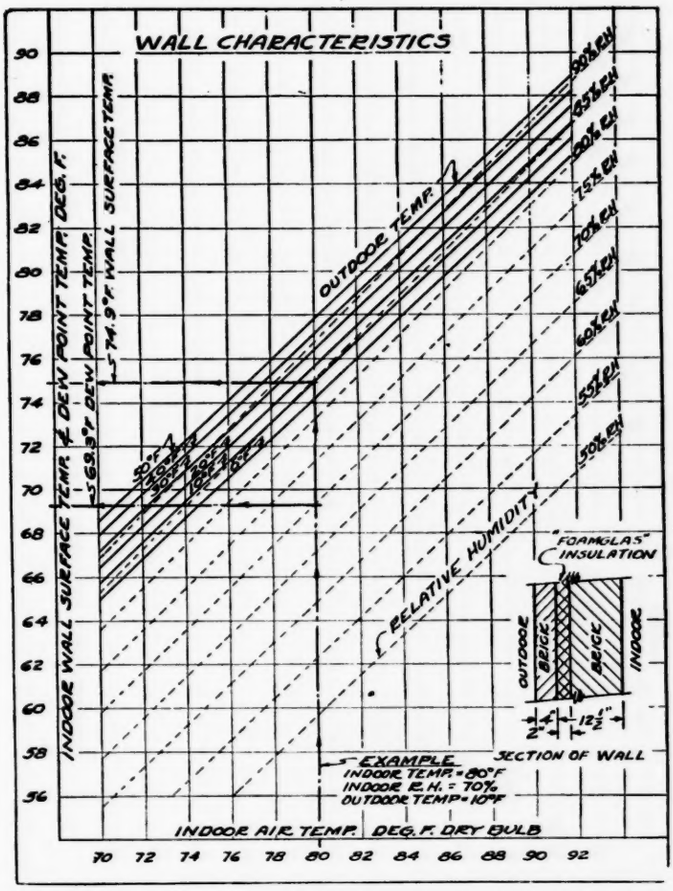


Fig. 3. Graph for determining dew point of inside of 12½ inch brick wall with insulation and additional outside course of brick.

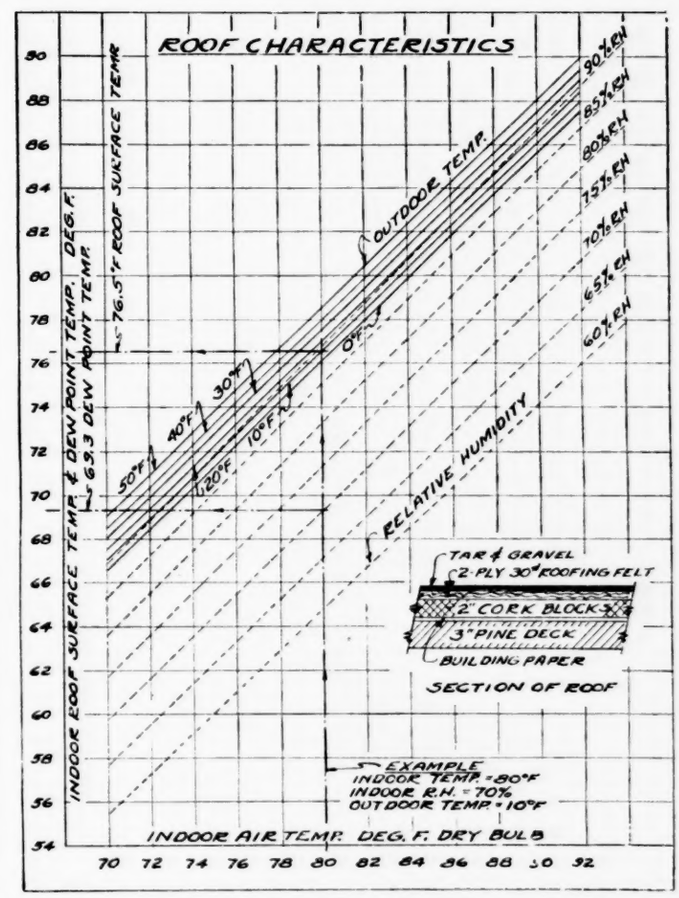


Fig. 4. Graph for determining dew point of underside of a typical roof of construction indicated under various temperature and humidity conditions.

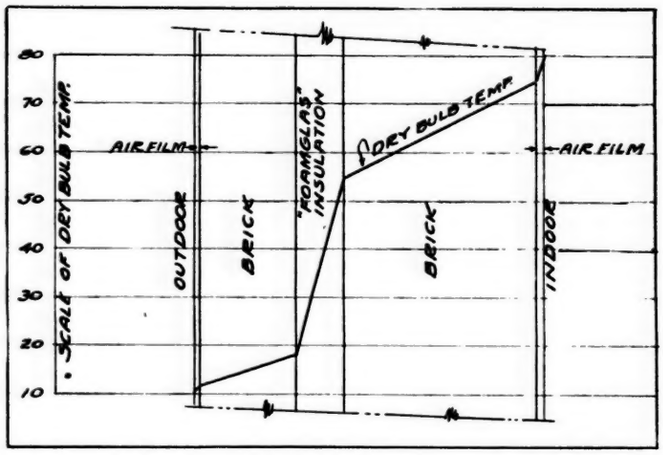


Fig. 5. Heat gradient through wall shown in Fig. 3 for an inside air temperature of 80F and outside temperature of 10F.

Heat flow is measured in Btu per hour; temperature difference in degrees F between the indoor temperature and the outdoor temperature; wall resistance is the reciprocal of conductance, and conductance is measured in Btu per hour per F temperature difference per square foot of wall face area.

To calculate wall heat flow problems for any specific project and for any specific temperature difference, it is best to establish a unit heat transfer factor for each type of wall construction. This factor is known as the *U* value of the wall and combines the various wall materials as well as the air film next to the interior face of the wall and the air films next to the exterior face of the wall. This *U* factor is measured in Btu per hour per square foot of face area, per F temperature difference between the interior and the exterior. Therefore if the total wall area is multiplied by the *U* factor and then by the temperature difference between the indoor and outdoor temperatures, the resultant will be the Btu per hour of heat flow through the wall. Since the *U* factor is for one F temperature difference, the heat flow law can now be written:

$$U = \frac{1}{\text{Resistance}} = \frac{1}{\frac{1}{\text{Conductance}}}.$$

The heat resistance of the wall is made up of the inside air film, the various wall materials, and the outside air film, and the heat must travel through each in series. Just as in the case of electricity, resistances in series with each other are added together to determine the total resistance. Since resistance is the reciprocal of conductance we can write the heat flow law:

$$U = \frac{1}{R_1 + R_2 + R_3 + R_n} = \frac{1}{\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \frac{1}{C_n}}$$

In Table 1 are shown the resistance factors for the more common materials used in industrial building construction. As shown in the table, $\frac{1}{C_h}$ is the resistance for the actual thickness of material as stated, whereas $\frac{1}{K_h}$ is the resistance for one inch thickness of the material. When $\frac{1}{K_h}$ is shown it is to be multiplied by the actual thickness in inches to obtain the $\frac{1}{C_h}$ or total resistance for that material. The last two columns in the table are the resistance factors for water vapor flow and will be discussed later.

The following tabulation shows the calculation involved in determining the *U* factor of the wall shown in Fig. 3. Values of K_h are from Table 1.

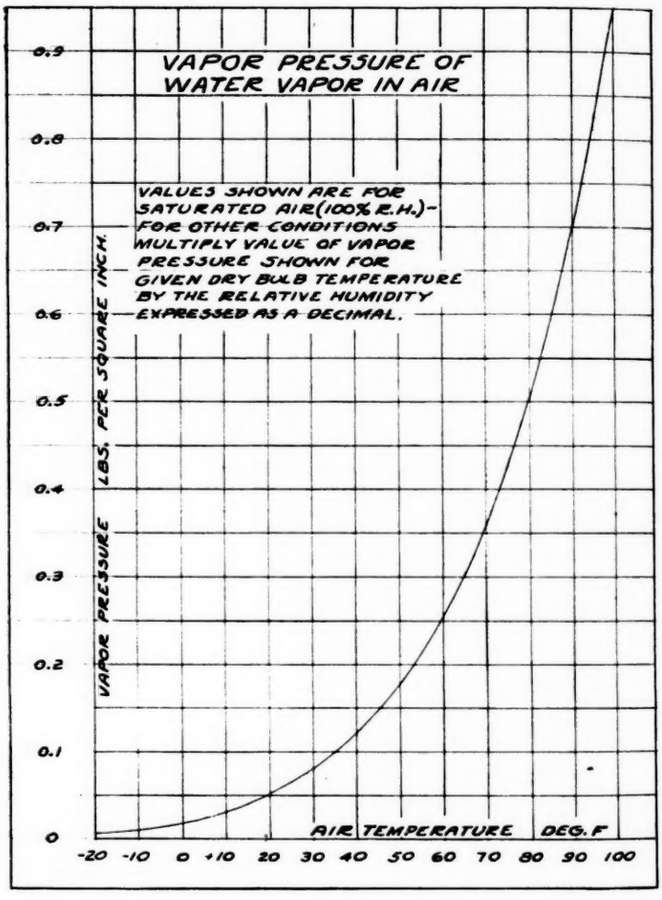

VAPOR PRESSURE OF WATER VAPOR IN AIR
VALUES SHOWN ARE FOR SATURATED AIR (100% R.H.) - FOR OTHER CONDITIONS MULTIPLY VALUE OF VAPOR PRESSURE SHOWN FOR GIVEN DRY BULB TEMPERATURE BY THE RELATIVE HUMIDITY EXPRESSED AS A DECIMAL.
VAPOR PRESSURE LBS. PER SQUARE INCH.
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
AIR TEMPERATURE DEG. F
-20 -10 0 +10 20 30 40 50 60 70 80 90 100

Fig. 6. Chart for determining vapor pressure, knowing air temperature and relative humidity, or for determining dew point, knowing the vapor pressure.

Material	$1/K_h$	Thickness	$1/C_h$
Outside air film	—	—	0.167
Brick	0.20	4 in.	0.800
Foamglas insulation	2.22	2 in.	4.440
Brick	0.20	12 in.*	2.400
Inside air film	—	—	0.606
Total resistance R =			8.413

(*Mortar joint not taken into account and is used as factor of safety).

$$U = \frac{1}{R} = \frac{1}{8.413} = 0.1188 \text{ Btu per hr per sq ft per F.}$$

For the example shown in Fig. 3 the temperature difference is 80F — 10F, or 70F. Therefore the heat flow through one square foot of wall surface will be 0.1188 × 70 = 8.32 Btu per sq ft per hr.

Since the heat flow rate is the same through each component part of the wall, the temperature drop through each part will be in direct accordance with the heat flow law, transposed to read Temperature Difference = Heat Flow × Resistance.

Substituting in the above for the inside air film we have temperature difference = 8.32 × 0.606 = 5.04F. This being the difference across the inside air film, which when subtracted from the indoor air temperature will result in the indoor wall surface temperature thus: 80 — 5.04 = 74.96F. This value is read on the chart as 74.9F, which is sufficiently accurate.

Likewise the temperature drop can be calculated for each part of the wall, as follows:

Material	Resistance		Heat Flow		Temp. Drop	Resultant Temp.
Outdoor air	—		—		—	10.000
Outside air film	0.167	×	8.32	=	1.39	11.39
Brick	0.800	×	8.32	=	6.66	18.05
Foamglas	4.440	×	8.32	=	36.94	54.99
Brick	2.400	×	8.32	=	19.97	74.96
Inside air film	0.666	×	8.32	=	5.04	80.00
	8.413					

U = 1/8.413 = 0.1188, and
0.1188 × (80 — 10) = 8.32 Btu per sq ft per hr.

Table 1 — Resistances of Building Materials to Flow of Heat and Water Vapor

Item No.	Material	Description	Heat Resistance $1/K_h$	Heat Resistance $1/C_h$	Vapor Resistance $1/K_v$	Vapor Resistance $1/C_v$
	Air Spaces					
1	Bounded by ordinary materials	Vertical, 1 in. wide	—	0.91	—	0.004
2	Bounded by aluminum foil	Vertical, 1 in. wide	—	2.17	—	0.604
3	Bounded by ordinary materials	Vertical, 3⅝ in. wide	—	0.91	—	0.014
4	Bounded by aluminum foil	Vertical, 3⅝ in. wide	—	2.17	—	0.614
	Insulating Materials					
5	Bats	Enclosed both sides	3.7	—	0.004	—
6	Cork blocks	Pure (10.6 lb per cu ft)	3.33	—	0.080	—
7	Cane fiber board	—	3.03	—	0.052	—
8	Foamglas	—	2.22	—	Infinite	
9	Sawdust	Dry	2.44	—	0.008	—
	Interior Finishes					
10	Metal lath and plaster	Plaster, ¾ in. thick	—	0.23	—	0.036
11	Insulating board (½ in.) and plaster	Plaster, ½ in. thick	—	1.67	—	0.033
12	Paint film	Aluminum, 1 coat on pine	—	0	—	0.14
13	Paint film	Aluminum, 2 coats on pine	—	0	—	0.93
14	Paint film	Enamel, 1 coat on pine	—	0	—	0.11
15	Paint film	Enamel, 2 coats on pine	—	0	—	0.39
	Masonry Materials					
16	Brick	Select hard common	0.20	—	0.11	—
17	Concrete	Light weight aggregate	0.40	—	0.10	—
18	Concrete	Sand and gravel aggregate	0.08	—	0.187	—
19	Clay tile	4 in. hollow	—	1.00	—	0.114
20	Clay tile	4 in. hollow-glazed face	—	1.00	—	0.25
21	Clay tile	8 in. hollow	—	1.67	—	0.17
22	Clay tile	12 in. hollow	—	2.50	—	0.20
23	Tile and terrazzo	For floors	0.08	—	0.25	—
24	Cement mortar	—	0.08	—	0	—
	Roofing Materials					
25	Built-up roofing	⅜ in. tar and gravel	—	0.28	—	1.15
26	Roofing felt, 2-ply	30 lb asphalt saturated	—	1.04	—	3.44
27	Building paper	Single thickness	—	—	—	0.01
	Woods					
28	Pine	Yellow, unpainted	1.25	—	0.66	—
29	Maple	Unpainted	0.83	—	0.80	—
30	Plywood	5/16 in. thick douglas fir	—	0.39	—	0.12
	Air Film					
31	Outside, vertical	15 mph wind	—	0.167	—	0
32	Outside, horizontal	15 mph wind	—	0.167	—	0
33	Inside, vertical	Still air	—	0.606	—	0
34	Inside, horizontal	Still air heat flow up	—	0.513	—	0
35	Inside, horizontal	Still air heat flow down	—	0.827	—	0
	Glass					
36	Glass block, 3⅞ in. thick	Smooth surface	—	1.20	Infinite	
37	Glass block, 3⅞ in. thick	Ribbed surface	—	1.40	Infinite	
38	Window glass, single	⅛ in. thick	—	0.11	Infinite	
39	Window glass, double	⅛ in. glass and ¼ in. space sealed	—	0.84	Infinite	

Fig. 5 is a cross section of the wall shown in Fig. 3, and the individual temperature drop through each part of the wall as calculated in the foregoing is plotted on the wall section.

The theory of water vapor transmission through the wall is similar to that of heat transfer mentioned before. Thus water vapor will flow from a higher vapor pressure or dew point to a lower vapor pressure or dew point, and the rate of flow and dew point gradient is dependent upon the vapor pressure differences and the vapor resistance characteristic of the wall or substance. For vapor flow the law may be written:

$$\text{Vapor Flow} = \frac{\text{Vapor Pressure Difference}}{\text{Wall Resistance}}.$$

Vapor flow is measured in grains per hour, vapor pressure difference in pounds per square inch between the indoor and outdoor vapor pressures. Wall resistance is the reciprocal of wall permeability and permeability is measured in grains per square foot per hour with one pound per square inch difference in vapor pressure. Wall resistance factors are shown in Table 1. These factors, however, are not yet so well established as those for heat flow and experimental work is still under way to determine additional factors as well as to check existing data.

Vapor pressure is dependent on the dry bulb temperature and the relative humidity, which, in turn, determines the dew point. Fig. 6 is a curve by which the vapor pressure can be determined for any dry bulb temperature when the relative humidity is known. For instance with 80F dry bulb temperature and 70% relative humidity project upward from the 80F point to the intersection of the curve, thence to the left and read 0.505 lb per sq in. This would be the vapor pressure if the air were completely saturated, in other words at 100% RH, but for 70% RH the value of 0.505 should be multiplied by the relative himidity expressed as a decimal: $0.505 \times 0.70 = 0.3535$ lb per sq in.

Knowing the vapor pressure, to determine the dew point, enter Fig. 6 at the left at 0.3535 and project to the right to intersect the curve, thence downward to the temperature at the bottom and read 69.3F.

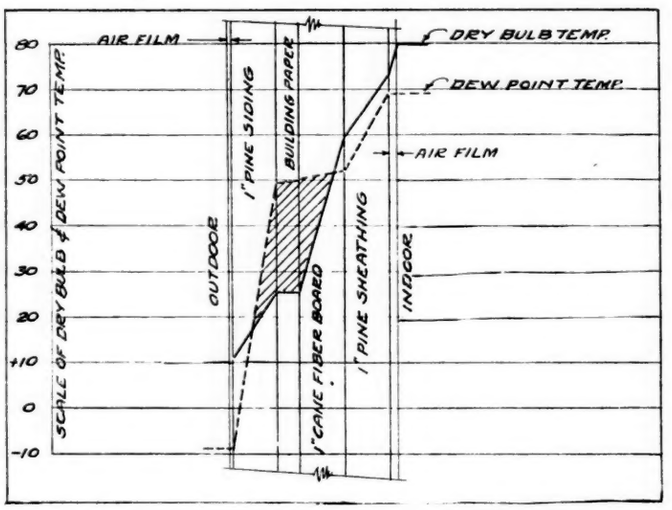


Fig. 7. Plot of heat and dew point gradients for construction and inside and outside conditions indicated.

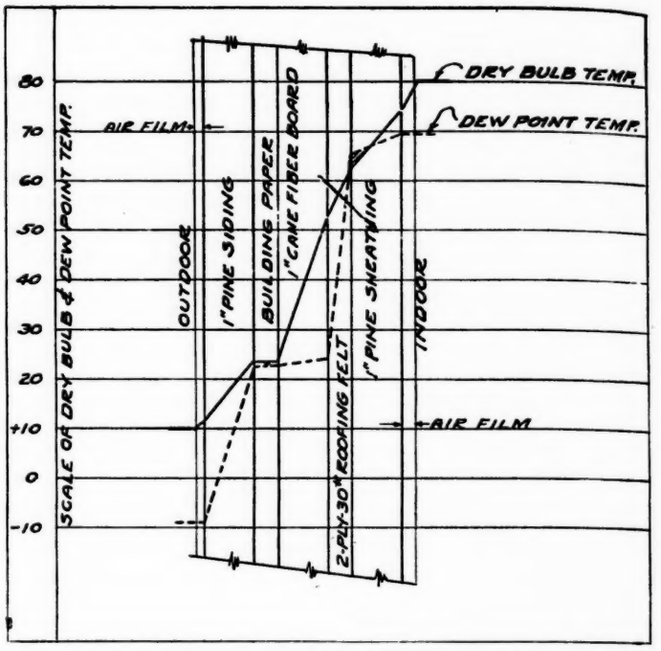


Fig. 8. Fig. 7 indicated condensation in the construction shown in that drawing. With the construction shown here, the heat and dew point gradients indicate no such trouble.

Therefore, at any point through the wall, if we can determine the vapor pressure, we can determine the dew point at that location. Vapor pressure gradient, and hence dew point gradient, can be determined in a similar manner to dry bulb temperature, as previously shown.

In order to have an example of the method of determining the dew point gradient, the wall shown in Fig. 7 is selected. The following tables show the method of arriving at the dry bulb temperature gradient and the dew point gradient, when the indoor air is at 80F, 70% RH, and outdoor air at 10F and 40% RH.

The temperature gradient is determined as follows:

Material	Resistance		Heat Flow		Temp. Drop	Resultant Temp.
Outdoor air	—		—		—	10.00
Outside air film	0.167	×	11.11	=	1.85	11.85
1 in. pine siding	1.250	×	11.11	=	13.88	25.73
Building paper	—		—		—	—
1 in. cane fiber board	3.030	×	11.11	=	33.66	59.39
1 in. pine sheathing	1.250	×	11.11	=	13.88	73.27
Inside air film	0.606	×	11.11	=	6.73	80.00
	6.303					

$U_h = 1/6.303 = 0.1587$, and
$0.1587\ (80 - 10) = 11.11$.

For the given outdoor air conditions, find, using Fig. 6, that the vapor pressure is as follows:

$$0.03 \times 0.4 = 0.012 \text{ lb per sq in.}$$

Likewise, with 80F dry bulb and 70% RH indoors, the vapor pressure is found to be $0.505 \times 0.7 = 0.3535$ lb per sq in. The dew point gradient is then calculated as follows:

Material	Resistance		Vapor Flow		Vapor Pressure Drop	Vapor Pressure	Dew Point
Outside air film	0.000	×	—	=	—	0.0120	9.0
1 in. pine siding	0.660	×	0.2471	=	0.163	0.1751	49.5
Building paper	0.010	×	0.2471	=	0.0025	0.1776	50.0
1 in. cane fiber board	0.052	×	0.2471	=	0.0128	0.1904	52.0
1 in. pine sheathing	0.660	×	0.2471	=	0.1631	0.3535	69.3
Inside air film	0.000						
	1.382						

$U_v = 1/1.382 = 0.7236$, and
$0.7236\ (0.3535 - 0.012) = 0.2471$

In the foregoing, the dew point is determined by use of Fig. 6 as previously explained. The results are plotted on Fig. 7.

Note from Fig. 7 that the dew point temperature at the indoor face of the wall is less than the dry bulb temperature of the wall face; hence there will be no condensation on the surface of the wall. But note, however, that at a point just inside the cane fiber board, the two temperatures become equal and that through the rest of the wall to a point about midway of the siding, the dew point temperature is greater than the dry bulb temperature. Condensation will therefore occur in the area shown by crosshatching, and the condensation of water vapor in the cane fiber board will tend to injure the board and reduce its resistance to both heat and vapor.

What then can be done to eliminate the trouble of internal wall condensation? The entire wall construction can be changed, thicker insulation used, or a vapor barrier installed in the wall. Fig. 8 shows the same wall but with a layer of two ply roofing felt placed between the sheathing and the cane fiber board. Note that condensation now occurs in a small portion of the sheathing only and the harm done by it will be of no consequence. Two coats of aluminum paint on the inner face of the sheathing would be of additional service as a vapor barrier.

Using the methods of calculations and the constants listed herein, other types of walls and roof can be calculated and diagrams drawn to determine the action of the dry bulb temperature and the dew point temperature in the various parts of the structure. Of course all calculations have been based on steady heat flow and stationary air conditions. The outdoor air conditions vary from hour to hour, hence the heat flow will not be exactly steady. However, if the structure is designed to be satisfactory under steady flow and with minimum design temperature and humidity conditions for that territory, it will be satisfactory for actual conditions of that territory.

Influence of Food on Body Heat

One of the key factors which has enabled the Eskimos to resist sub-zero temperatures lies in the food they eat, according to the results of experiments reported to the Refrigeration Equipment Manufacturers Association. For blubber is a fat, and 18 months of experiments at the University of Illinois research hospital have proven that a high fat diet provides the best resistance to sub-zero temperatures because of its heat producing qualities.

Conscientious objectors, assigned to the hospital for the experiments during the war, spent many days in a room mechanically refrigerated to a temperature of 20 degrees below zero to determine what type of foods would be best suited for combat troops in frigid zones. At various times of the day, the subjects of the experiment were given tests to determine the effect of the cold on their ability to perform, think, see, hear and co-ordinate.

According to the reports to REMA, the experiments indicated that cold has little mental effect upon a human being, but it was proven definitely that low temperatures reduce the efficiency of the average individual. Muscular reaction is slower and the ability tc perform even simple tasks is hampered by extreme cold, the University of Illinois experiments indicated.

During the experiments, efforts were made to determine if vitamin fortification could be depended upon as a means of building resistance to sub-zero temperatures. Tests along this line showed that an adequate amount of vitamins is essential in maintaining high resistance to the cold, but it was also indicated that excessive amounts of vitamins have no effect whatsoever on an individual's ability to withstand low temperatures.

Although the experiments proved that the average individual will develop more resistance to the cold on a fat diet, the tests also showed that performance ability is improved by a high carbohydrate diet. In addition, the experiments showed that the subjects on a high carbohydrate diet require more food than those on a protein or fat diet to maintain body weight, indicating that carbohydrates tend to exhaust themselves in the production of body heat.

The fat content of the diet was stepped up with butter, cream and cooking and salad oils. The protein diet was fortified with extra portions of meat, eggs and cottage cheese and the carbohydrate diet included large amounts of candy, sugar, jelly and other sweets.

Further use of mechanical refrigeration and air conditioning to study the effect of various temperatures and humidities on human subjects is being planned by the University of Illinois as soon as new equipment and laboratories can be constructed.

Plans include an aero-medical and atmosphere environment unit which will consist of six separate laboratories for treatment and research with human subjects. Each of the laboratories will be equipped with special equipment designed by the refrigeration industry to provide temperatures from 40F to 120F and a range of relative humidities from 20 to 90%.

In addition, three large air conditioning installations are planned for the College of Medicine for experiments dealing with air pressure, humidity controls and air filtration and their effects on human subjects.

Ventilation of

Passenger Elevator Cabs

T. W. REYNOLDS

The ventilation of passenger elevator cabs, especially in department stores or other places where comfort of the public is a deciding factor, is receiving increasing attention from design engineers. Mr. Reynolds gives practical pointers on the unusual problems involved in ventilation of elevator cabs.

NOT so long ago there was no ventilation of any kind in elevator cabs, but in the short lapse of time since ventilation has been extended to include elevators, much has been learned about how it should be applied. Manufacturers today are giving this subject serious consideration and are now determining results in advance in the shop or laboratory rather than in the field.

With the realization that elevator cabs should be ventilated, especially so when installed in department stores, it was thought that simple ventilation by a propeller-type fan would suffice. Such fans, however, varied in speed, or even ran backward, depending upon the speed, direction, or the piston effect of a cab, although the last is less noticeable if there are two or more cabs in the same shaft. As improvements were made in the method of ventilation, other complaints arose regarding noise of fan, drafts on the heads of occupants, and lack of air diffusion; further, a condition satisfactory to the comfort of the passengers was often too drafty for the elevator operator continuously exposed.

The accompanying sketches show one of the more modern ways of ventilating an elevator cab, though there is as yet no set standard arrangement even with the same cab manufacturer. Installations vary from the quantity of air handled to the method of distributing the air, and whether introduced by an exhaust or by a supply fan. For example, in some installations, large quantities of air are handled through a plenum space with a blower on multiple speed operation on three speeds, as, for example, 1425 cfm, 800 cfm and 575 cfm.

The quantity of air that can be handled without complaints varies with the method of distribution, even as it does with the ventilation of any other kind of space; however, the method of distribution must be more carefully designed with a space so small and so crowded as in an elevator cab. Some fan installations have gone to two speeds with the high speed giving only 320 cfm, which seems too extreme on the down or low speed side.

If we neglect the lighting load, which may be fluorescent and can be removed by exhaust air, we would require 600 cfm to remove the sensible heat in an 18 passenger cab at, say, 75% hourly occupancy, thus (18 passengers $\times$ 75% + 1 operator) $\times$ 225 Btu = 3263 Btu per hour, or 54 Btu per minute, requiring, at a 5° temperature rise, 54 $\div$ (.018 $\times$ 5°) = 600 cfm. If the air is blown into the cab rather than exhausted, then the heat of the lights will require additional air for its removal.

Of course, one can't quite determine the necessary air quantity so theoretically as by the foregoing calculations, since the door is frequently opened and some heat goes out of the door; furthermore, the quantity of air must be limited to avoid drafts. Just where the limit should be depends upon the method of ventilation (supply, exhaust or plenum) and how well the air

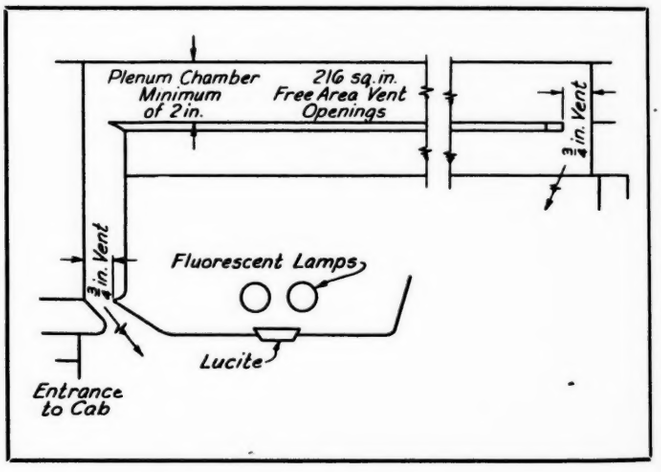


Fig. 1. Section through plenum chamber.

is distributed. If too much air is introduced, the car operator will stop the fan and there won't be any ventilation, and if it is insisted that the fan run there may be ventilation in the car but no operator.

The arrangement for air distribution by means of a plenum chamber as shown in the sketches has certain advantages. The air is under a constant pressure, hence more air can be handled for heat removal, yet without drafts, since the air is equally distributed through vent openings, usually on all four sides of the cab. The controlling factor is 216 sq in. of free air area, regardless of the size of the car. The air leaves by perforations around the cab sides at the floor, as well as by clearance around the door, which of neces-

sity is usually ¼ in. The fan is of the squirrel-cage type and the plenum chamber, which has a minimum height of 2 in., stores the air to the extent that direction of car does not affect air delivery, which remains constant.

Sometimes a circular air diffuser is used to blow the air in through the ceiling of the cab. Such an outlet of the right type makes for good appearance and also will give good diffusion, especially when fitted with volume control and dampers for equalization of the air over the face of the outlet. The connecting duct for practical reasons should be 2 in. wider than the neck of the outlet and of height sufficient to give an area of duct 20% greater than the area of the neck. This reduces the velocity of air in the duct to well below the neck velocity (it should be at least 100 fpm less), converting velocity energy into pressure energy, as desirable for good air distribution. Extending the duct slightly past the neck of the outlet also helps.

Exhausting the air from the top of the cab is a method having much in its favor, since it avoids blowing the air down upon the heads of the occupants and allows the air to enter equally from the bottom openings of the cab by suction. The air then leaves the cab by way of a ceiling grille or a circular air diffuser working backward. In some cases, no particular dependence for ventilation is placed upon the bottom inlet perforations at the floor, except to limit their area to the extent that the cab may be under ½ in. of vacuum while in motion. As soon as the door is opened, air is rapidly drawn into the vacuum through the cab door from the conditioned space. In a department store, stops are made at each floor so that the door is open a large part of the time. As the door is opened, the resistance becomes less, so that the fan then exhausts much more air. Exhausting the air also allows the heat of the cab lights to be exhausted above the occupied space through holes around the lights.

In addition to being comfort conscious, we have also become noise conscious, so that it becomes desirable to deaden the noise of the fan by a canvas connection to the duct and to install acoustical lining within the duct. There is no point in insulating, however, unless other noises are eliminated, so that in some installations the cab is also insulated throughout.

It may be that in time we will find it desirable to air condition elevator shafts, though comfort within a cab is probably best obtained by air motion rather than by cool air. Blowing conditioned air into an elevator shaft would be particularly desirable in such cases as those where a kitchen is so close to the elevator shafts as to fill the shafts with its odor when these shafts are not under pressure.

Air blown into a shaft would also supply the make-up air to the elevator pent house where motors are cooled by the action of exhaust fans in the pent house. As a rule, there are sufficient openings at the top of the shaft around the elevator cables and machinery for the make-up air to flow into the pent house. Removing the motor heat calls for a lot of air, especially if the make-up air is from outdoors at, say, 95F. If make-up air is taken through elevator doors when opened to the conditioned space, the quantity is still considerable, even though such air is as low as 80F. If there is plenty of throw-away conditioned air there is no refrigeration loss, but where the air is blown directly into the elevator shafts from the conditioned air ducts at 60F, there is, of course, a certain amount of load upon the refrigerating system. On the other hand, air at 60F can be much less in quantity when used as make-up air to cool elevator motors, so that the pent house exhaust fan can be smaller, the in-rush

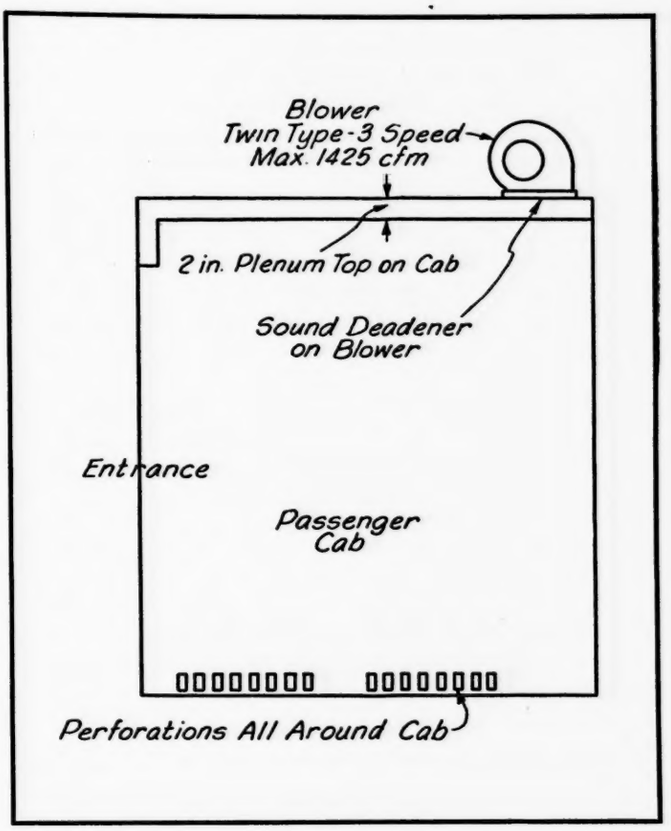


Fig. 2. Section through cab.

of air to the shafts will be less, and the cabs will have an air content which is cooler. Not all of the conditioned supply air is a refrigeration loss when blown direct into a shaft, for the conditioning of the shafts eliminates any heat gain to the conditioned space through partitions enclosing the elevator shafts.

An elevator pent house with windows on four sides, or otherwise arranged for good cross ventilation, will be fairly cool. On the other hand, the life of motors is considerably less if the temperature immediately surrounding them goes above 104F. If the outside air at 95F is depended upon for ventilation, then the heat removed is only that which can be obtained with a temperature rise of 9F. At such a low rise, the quantity of air required is so great that it may not be obtainable by natural means on many days.

Introduction of air through a duct into an elevator shaft will meet with no objections from insurance underwriters (though they do not prefer it), providing such a duct is fitted with a fire damper which automatically closes by the melting of a fusible link due to a fire on either side of the damper.

Unit Fuel Requirements at Various Efficiencies

The amount of fuel required to produce a given amount of heat at a given system efficiency is just another simple but tedious procedure that engineers are required to go through. The tables presented in this article eliminate this chore work and show fuel requirements per 1000 Btu directly.

THE accompanying charts are designed to show directly the quantity of fuel to be burned to produce 1000 net Btu at various efficiencies.

Table 1 can be used for coal, coke, wood or any other fuel whose heating value is in the range from 5,000 to 14,500 Btu per lb. Table 2 covers oil, with the heating value given both in commercial standard numbers and in Btu per gal, heating values for the standard numbers being approximate. Table 3 covers natural and manufactured gas with heating values of 1000, 800, 550 Btu per cubic foot. The factors in the body of Table 3 when used as whole numbers without the decimal represent the fuel quantity to produce one therm (100,000 Btu), a heat quantity frequently used in the gas industry.

The charts were designed by C. H. Koper, B. F. Sturtevant Division, Westinghouse Electric Corp., Buffalo, N. Y.

Table 1.—Pounds of Solid Fuel Required to Produce 1000 Btu.

Heat Content, Btu per Pound of Fuel	Overall Efficiency, Per Cent													
	45	47½	50	52½	55	57½	60	62½	65	67½	70	72½	75	80
	Pounds of Fuel to Produce 1000 Btu Output													
5000	.4444	.4211	.4000	.3810	.3636	.3478	.3333	.3200	.3076	.2963	.2858	.2759	.2667	.2500
5250	.4232	.4010	.3810	.3628	.3464	.3312	.3174	.3048	.2930	.2822	.2722	.2627	.2540	.2380
5500	.4040	.3827	.3636	.3463	.3306	.3163	.3034	.2909	.2798	.2693	.2598	.2508	.2424	.2272
5750	.3864	.3662	.3480	.3312	.3162	.3025	.2898	.2782	.2676	.2577	.2484	.2399	.2320	.2174
6000	.3704	.3509	.3333	3175	.3030	.2899	.2776	.2667	.2564	.2469	.2380	.2299	.2222	.2084
6250	.3556	.3368	.3200	.3048	.2910	.2782	.2667	.2560	.2462	.2370	.2286	.2207	.2134	.2000
6500	.3419	.3238	.3076	.2930	.2798	.2676	.2564	.2461	.2366	.2279	.2198	.2122	.2052	.1924
6750	.3292	.3119	.2964	.2822	.2694	.2577	.2470	.2371	.2280	.2195	.2116	.2043	.1976	.1852
7000	.3175	.3008	.2858	.2721	.2598	.2484	.2381	.2286	.2198	.2116	.2041	.1970	.1905	.1786
7250	.3065	.2904	.2759	.2627	.2508	.2398	.2299	.2207	.2122	.2043	.1970	.1903	.1839	.1724
7500	.2963	.2807	.2667	.2539	.2424	.2318	.2222	.2331	.2051	.1975	.1905	.1839	.1778	.1667
7750	.2867	.2717	.2581	.2458	.2346	.2244	.2151	.2064	.1985	.1912	.1843	.1780	.1720	.1613
8000	.2778	.2632	.2500	.2381	.2273	.2174	.2083	.2000	.1923	.1852	.1786	.1724	.1667	.1563
8250	.2693	.2552	.2424	.2309	.2204	.2106	.2020	.1939	.1865	.1796	.1732	.1672	.1616	.1515
8500	.2614	.2476	.2353	.2241	.2139	.2046	.1961	.1882	.1810	.1743	.1681	.1623	.1569	.1471
8750	.2539	.2406	.2286	.2177	.2078	.1988	.1905	.1828	.1758	.1693	.1633	.1576	.1524	.1429
9000	.2469	.2339	.2222	.2116	.2020	.1932	.1852	.1778	.1709	.1646	.1587	.1533	.1481	.1389
9250	.2402	.2276	.2162	.2059	.1965	.1880	.1802	.1730	.1663	.1602	.1544	.1491	.1441	.1351
9500	.2339	.2216	.2105	.2005	.1914	.1830	.1754	.1684	.1619	.1559	.1504	.1452	.1404	.1316
9750	.2279	.2159	.2051	.1954	.1865	.1784	.1709	.1641	.1579	.1520	.1465	.1415	.1367	.1282
10000	.2222	.2105	.2000	.1905	.1818	.1739	.1667	.1600	.1538	.1481	.1429	.1379	.1333	.1250
10250	.2168	.2054	.1951	.1858	.1774	.1697	.1626	.1561	.1501	.1445	.1394	.1346	.1301	.1220
10500	.2116	.2005	.1905	.1814	.1732	.1656	.1587	.1524	.1465	.1411	.1361	.1314	.1270	.1190
10750	.2067	.1958	.1860	.1772	.1720	.1618	.1550	.1488	.1431	.1378	.1329	.1283	.1246	.1163
11000	.2020	.1914	.1818	.1732	.1653	.1581	.1515	.1455	.1399	.1347	.1299	.1254	.1212	.1136
11250	.1975	.1871	.1778	.1693	.1616	.1546	.1481	.1422	.1367	.1317	.1270	.1226	.1185	.1111
11500	.1933	.1830	.1740	.1656	.1581	.1512	.1449	.1391	.1338	.1288	.1242	.1199	.1159	.1087
11750	.1891	.1792	.1702	.1621	.1547	.1480	.1418	.1362	.1309	.1261	.1216	.1174	.1135	.1064
12000	.1852	.1754	.1667	.1587	.1515	.1449	.1389	.1333	.1282	.1235	.1190	.1149	.1111	.1042
12250	.1814	.1719	.1633	.1555	.1484	.1418	.1361	.1306	.1256	.1209	.1166	.1126	.1088	.1020
12500	.1778	.1684	.1600	.1524	.1455	.1391	.1333	.1280	.1231	.1185	.1143	.1103	.1067	.1000
12750	.1743	.1651	.1569	.1494	.1426	.1364	.1307	.1255	.1207	.1162	.1120	.1082	.1046	.0980
13000	.1709	.1619	.1538	.1465	.1399	.1338	.1282	.1231	.1183	.1140	.1099	.1061	.1026	.0962
13250	.1677	.1589	.1509	.1438	.1372	.1313	.1258	.1208	.1161	.1118	.1078	.1041	.1006	.0943
13500	.1646	.1559	.1482	.1411	.1347	.1288	.1235	.1185	.1140	.1097	.1058	.1022	.0988	.0926
13750	.1616	.1531	.1455	.1385	.1322	.1265	.1212	.1164	.1119	.1077	.1039	.1003	.0970	.0909
14000	.1587	.1504	.1429	.1361	.1299	.1242	.1190	.1143	.1099	.1058	.1020	.0985	.0952	.0893
14250	.1559	.1477	.1404	.1337	.1276	.1220	.1170	.1123	.1080	.1040	.1003	.0968	.0936	.0877
14500	.1533	.1452	.1379	.1314	.1254	.1199	.1149	.1104	.1061	.1022	.0985	.0951	.0920	.0862

Table 2.—Gallons of Oil Required to Produce 1000 Btu.

Heat Content, Btu per Gal. of Oil	Overall Efficiency, Per Cent												
	50	52½	55	57½	60	62½	65	67½	70	72½	75	77½	80
	Gallons of Oil to Produce 1000 Btu												
No. 1—136,000	.01470	.01401	.01337	.01279	.01225	.01176	.01131	.01089	.01050	.00101	.00980	.00949	.00919
No. 2—138,500	.01444	.01394	.01313	.01256	.01203	.01155	.01111	.01070	.01031	.00100	.00963	.00932	.00903
No. 3—141,000	.01419	.01351	.01300	.01234	.01182	.01135	.01091	.01051	.01013	.00980	.00946	.00916	.00887
No. 4—145,000	.01380	.01314	.01254	.01199	.01149	.01103	.01061	.01022	.00985	.00953	.00920	.00899	.00862
No. 5—148,500	.01347	.01283	.01224	.01171	.01122	.01077	.01036	.00997	.00962	.00931	.00898	.00870	.00843
No. 6—152,000	.01316	.01253	.01196	.01141	.01096	.01053	.01012	.00984	.00940	.00907	.00877	.00849	.00822

Table 3.—Cubic Feet of Gas Required to Produce 1000 Btu.

Heat Content, Btu per Cubic Foot	Overall Efficiency, Per Cent												
	50	52½	55	57½	60	62½	65	67½	70	72½	75	75½	80
	Cubic Feet of Gas to Produce 1000 Btu												
1000	2.000	1.905	1.818	1.739	1.666	1.600	1.539	1.481	1.429	1.379	1.333	1.325	1.250
800	2.500	2.381	2.272	2.174	2.083	2.000	1.923	1.852	1.786	1.724	1.666	1.656	1.563
550	4.000	3.463	3.311	3.162	3.030	2.910	2.797	2.694	2.600	2.508	2.427	2.408	2.295

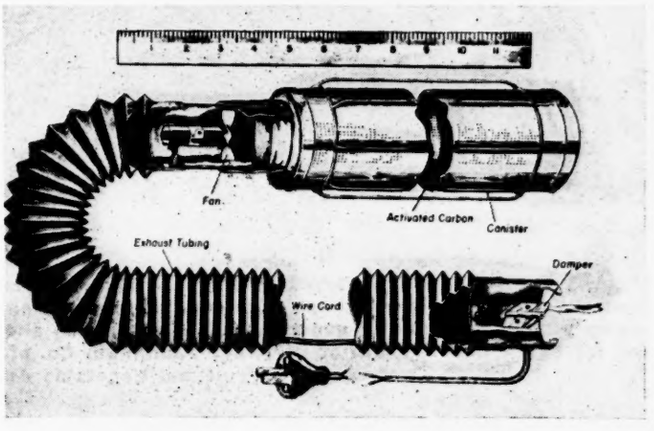
Hospital Plane Litter Deodorizer

Developed for use in hospital evacuation planes, a new Dorex unit made by W. B. Connor Engineering Corp. is expected to find widespread use in hospitals and wherever it is desired to remove odors emanating from a highly localized or confined origin. Data on the unit, studied under Research Project X-533, has been released by the Naval Medical Research Institute.

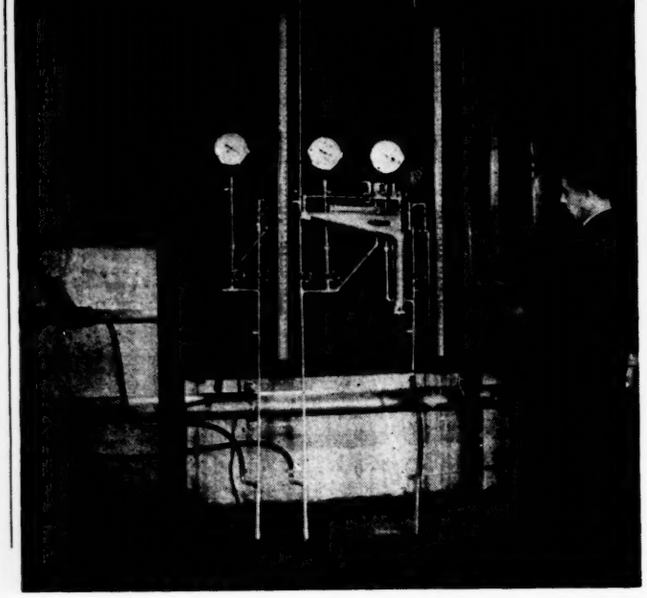
In the airborne evacuation of battle casualties, it was found that draining wounds, casts, gangrenous infections, etc., emitted odors frequently so intense as to cause nausea among other occupants of hospital planes. A search for the most effective methods of controlling such odors resulted in the adoption of carbon adsorption made possible by a unit which was specially designed for this service.

A perforated, activated carbon-filled canister is placed under the blanket or coverlet with the patient and as near as practical to the odor source. A small built-in fan draws the odor-laden air through the carbon canister where the odors are extracted. The deodorized air is discharged to the surrounding space through a short length of flexible duct. This localized exhaust creates a slight negative air pressure under the blanket thereby preventing any exfiltration of odorous air. The exhausting of but 10 cfm is sufficient both to maintain satisfactory results and inhibit drafts perceptible to the patient.

An idea of the immediate and lasting effectiveness of this simple device may be gained from test procedure described in the Naval research report. Placed in a blanket-covered cage with a rabbit which had been inoculated with *Clostridium Perfringens* (gas gangrene), killed, and incubated overnight at blood temperature, a Dorex unit with a ¾-in. bed of activated carbon so controlled even this overpowering odor generation that the room remained completely odor-free for seven days before saturation of the carbon was reached.



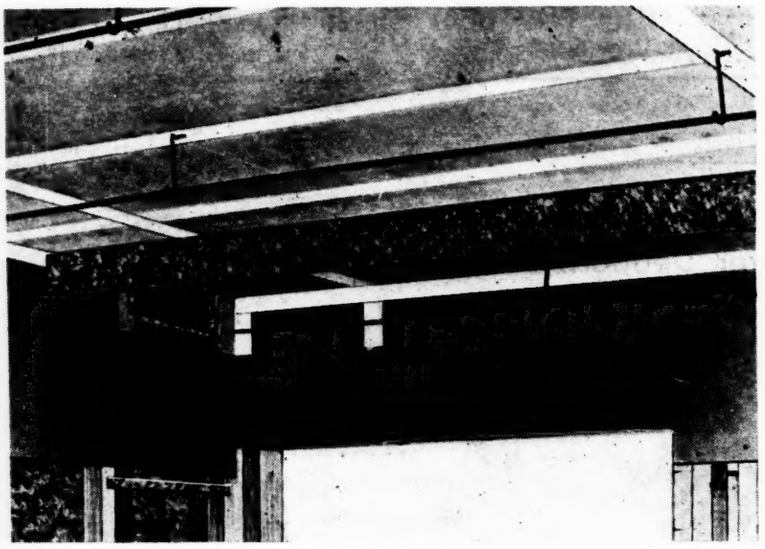
Tiny motor and fan exhaust 10 cfm through ¾-in. bed of activated carbon from localized odor source to room air.



(Above) Unique flow test hook-up designed by laboratories of Edward Valves, Inc., provides readings of pressure loss through various types of valves under differing service conditions. Valve at left is under test. Results guide design of new types of valves.

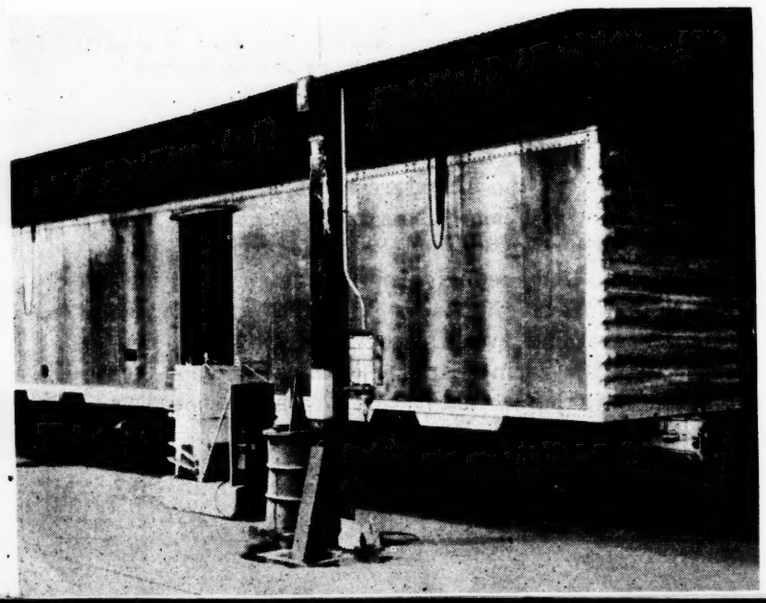
(Above) Carrier Corp. engineers watch test on one of two of the largest sulphur dioxide compressors ever made (first of their type in U. S.). Machines will be used by Standard Oil of California in auto refrigeration solvent process in refining oil. Each centrifugal compressor will operate on 633 hp at 9,840 rpm with four impellers direct driven by turbine using steam at 675 lb per sq in. and exhausting at 175 lb per sq in.

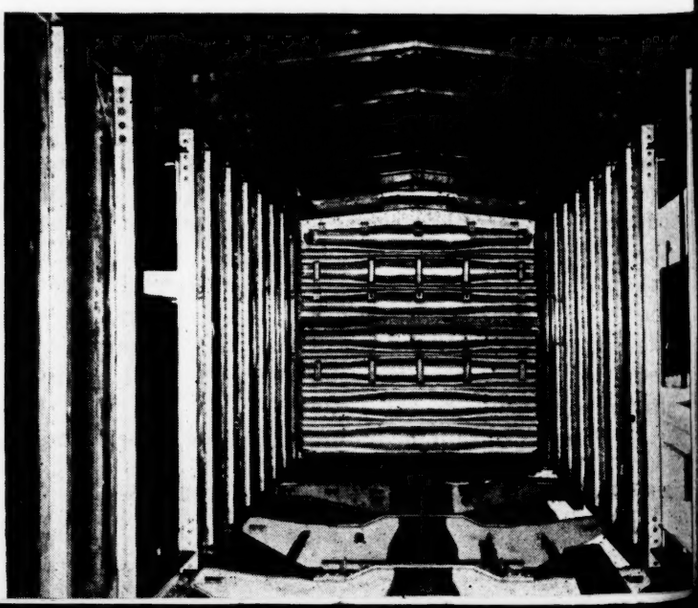
Picture Paragraphs



(Left) A stage in installation of a "Panelaire" warm air radiant heating system using a Luxaire gas fired forced air furnace made by C. A. Olsen Mfg. Co. who designed the system. Duct opening at left introduces warm air to space formed by sheet rock, shown nailed to rafters, and a second plaster ceiling to be formed on metal lath attached to round rods shown suspended by hooks. Galvanized strips guide air through whole ceiling area. None of the warmed air enters the room.

(Below) Exterior and interior views of a new aluminum refrigerator car that doubles as a boxcar nearing completion at Illinois Central's McComb, Miss., shops. Car, equipped with folding bulkheads for use as a boxcar, is said to be 25% lighter than ordinary "ice" cars due to generous use of aluminum and glass installation. Inside are built-in fans and air ducts for cooling and ice boxes that fold out of the way. Aluminum Co. of America, the Association of American Railroads, and United Fresh Fruit and Vegetable Association cooperated in the project.





Cold Water Piping in Industrial Plants

Part 4: Water Hammer

HARRY D. UNWIN
Mechanical Engineer, Albert Kahn Associated Architects and Engineers, Inc.

The forces resulting in the phenomenon of water hammer are analyzed in this concluding section of Mr. Unwin's four-part article.

We have seen from the theoretical considerations that the energy in the flowing water can be accounted for at any desired point in a piping system, even though some is dissipated as heat to the water and pipe. It is therefore apparent that the energy contained in the stream can be accounted for when the flow is suddenly checked.

If a gate valve, for example, is closed "instantaneously" there will be a sudden rise in pressure in the section of pipe upstream from the valve. The familiar banging noise of water hammer resulting from this increase in pressure will be more noticeable in pipes where the point of closure is relatively far from the source of water entering the pipe. This phenomenon may be basically explained by Newton's first law of physics which states that for every action there must be an equal and opposite reaction. In other words the reaction to the normal velocity of flow is the complete change of kinetic energy into pressure energy. This change is accompanied by a surge or pressure wave in the pipe away from the valve and travelling toward the inlet of the system; and is reflected in compression of the liquid, circumferential expansion of the pipe and frictional resistance to the wave travel. This wave propagation might be likened to the effect of suddenly stopping a slowly moving train and the cars behind the engine continue to move forward until the play in each coupling is successively taken up until the last car comes to rest. After the pressure wave has travelled back through the pipe to the source, which we shall refer to as the reservoir, the analogy with the train illustration ceases.

As soon as the pressure wave has reached the reservoir, the expanded pipe returns to its normal size at this point, thus expelling a "unit" of the compressed water into the reservoir, lowering the pressure and starting a uniform flow opposite in direction to the original or normal flow. As this change takes place progressively toward the closed valve, the effect is to again produce uniform flow and hence velocity in the water throughout the section of pipe upstream from the valve except in the opposite direction. Thus the "wave" which originated at the valve has travelled to the reservoir and back to the valve, completing one cycle, but the "unit" immediately upstream from the valve has moved away from this point thus reducing the pressure below the original normal pressure. Since fluid flow only occurs due to a difference in pressure, and there now exists a higher pressure at the source than at the valve, water will again enter the pipe from the reservoir causing a flow toward the valve. When this movement has again reached the valve, the "unit" nearest thereto is compressed as before and the cycle starts over again. However, since some of the energy is given up due to the loss of head caused by friction, there is less total energy to be dissipated during each successive cycle of the pressure wave and hence, the water gradually comes to a positive rest. It should be noted in passing that the water also comes to a temporary state of rest at each reversal of flow.

There are, theoretically, two classes of materials: (1) rigid and (2) elastic, and since steel pipe is known to expand under temperature and pressure, it must be considered as belonging to the latter classification. Many investigators, notably Prof. I. P. Church, have analyzed the phenomenon of water hammer and it is through their deductions that the following modified mathematical treatment of the effect of the sudden or instantaneous closure of valves in pipe lines through which water is flowing is based.

Fig. 8 represents a section of pipe of diameter D through which water is flowing at a normal velocity of V. When the gate is closed instantaneously, the section of the volume Q immediately upstream from the valve is compressed an amount equal to dL, or the shortened length of the segment of the volume is $L - dL$. At the same time, the compression has expanded the pipe, resulting in an increase in the diameter of dD. It can be shown that the volume or bulk modulus of elasticity of water is the ratio of the stress p per unit of area to the change or reduction dQ of the total volume Q. If K represents this elasticity relationship, then

$$K = p \frac{Q}{dQ}$$

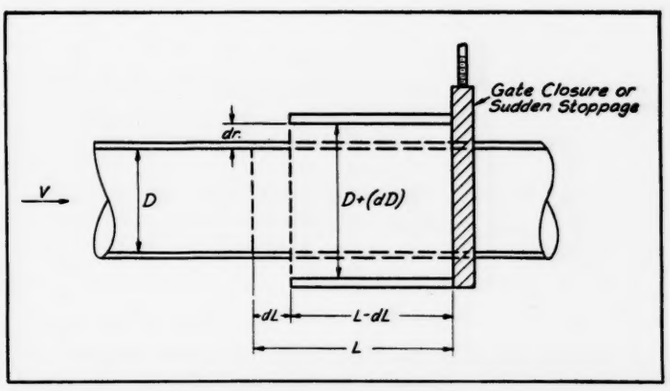


Fig. 8. Effect of water hammer in a pipe due to wave propagation.

Since

$$Q = \frac{\pi D^2}{4} \cdot L$$

and

$$dQ = \frac{\pi D^2}{4} dL - \pi D \frac{dD}{2} (L - dL)$$

then

$$K = p \left[\frac{\frac{\pi D^2 L}{4}}{\frac{\pi D^2}{4} dL - \pi D \frac{dD}{2} (L - dL)} \right] \quad (15)$$

Newton's Second Law of Motion states that

force = mass × acceleration

or

$$p \frac{\pi D^2}{4} = \frac{\pi D^2}{4} L \frac{w}{g} \times \frac{V}{dT}$$

where w = weight per unit of volume,
g = acceleration due to gravity,
V = normal velocity of the water,
dT = time for the pressure wave to travel the distance L, and
p = stress per unit of area

Solving for the inertia pressure

$$p = L \frac{w}{g} \frac{V}{dT}$$

and

$$L = p \frac{g}{w} \frac{dT}{V} \quad (16)$$

Let a equal the velocity of the pressure wave away from the valve toward the upstream source

$$a = L \div dT$$

then by substitution,

$$p = \frac{Vaw}{g} \quad (17)$$

If S is equal to the hoop tension in a pipe of diameter D and thickness t, then the average unit pressure p will produce a stress

$$S = \frac{D}{2} \cdot \frac{p}{t} \quad (18)$$

and if E represents the modulus of elasticity of the pipe material, and dC is the elongation of the pipe circumference due to the hoop stress, then

$$\frac{E}{S} = \frac{\pi D}{dC}$$

and

$$S = \frac{E\, dC}{\pi D} \quad (19)$$

Combining Equations (18) and (19),

$$E = \frac{p \pi D^2}{2t\, dC} \quad (20)$$

Since the circumference is a function of the diameter, we may equate the ratio of the change in unit length to the unit diameter

$$\frac{dC}{\pi D} = \frac{dD}{D} \quad \text{and} \quad dC = \pi\, dD \quad (21)$$

substituting the value of dC in Equation 20 and solving ing for dD,

$$E = \frac{p \pi D^2}{2t \pi\, dD} \quad \text{and} \quad dD = \frac{pD^2}{2tE} \quad (22)$$

Now placing this value of dD in Equation 15 and substituting the value of L from Equation 16, we have

$$K = \frac{\frac{\pi D^2}{4} \left(p^2 \frac{g}{w} \frac{dT}{V} \right)}{\frac{\pi D^2}{4} (dL) - \frac{Dp}{tE} \left(p \frac{g}{w} \frac{dT}{V} - dL \right) \frac{\pi D^2}{4}} \quad (23)$$

Since dL is negligible in relation to L in the expression $(L - dL)$, it may be neglected without the error influencing the result, hence

$$K = \frac{p^2 \frac{g}{w} \frac{dT}{V}}{dL - \frac{p^2 D}{tE} \frac{g}{w} \frac{dT}{V}} \quad (24)$$

Multiplying numerator and denominator by $\frac{wV}{dT}$ and substituting for $\frac{dL}{dT}$ its equivalent V,

$$K = \frac{p^2 g}{wV^2 - \frac{p^2 Dg}{tE}} \quad (25)$$

Rearranging, and solving for p

$$p = V \sqrt{\frac{w}{g} \left(\frac{KtE}{tE + KD} \right)} \quad (26)$$

Equating the values of the excess pressure p from Equation 26 and Equation 17 and solving for a

$$a = \sqrt{\frac{g}{w} \left(\frac{KtE}{tE + KD} \right)} \quad (27)$$

In order to satisfy the dimensions of these equations, if K and E are expressed in pounds per square inch, and t and D are in inches, with w being in pounds per cubic foot, it is necessary to multiply the bulk modulus and the modulus of elasticity by 144. If Equation 27 is rewritten

$$a = \sqrt{\frac{g}{w} K} \cdot \sqrt{\frac{tE}{tE + KD}}$$

the expression $\sqrt{\frac{g}{w} K}$ is identical with that for the velocity of sound in water; and if $K = 294{,}000$ lbs per sq in. at near freezing temperature, the velocity of the compression wave in a rigid pipe is 4700 fps.

For normal temperatures such as exist for most piping problems within industrial buildings, the following values may be substituted in Equation 26 and Equation 27.

$E = 30{,}000{,}000$ lb per sq in. for steel
$K = 300{,}000$ lb per sq in. for water
$w = 62.4$ lb per cu ft
$g = 32.2$

then Equation 26 becomes

$$p \text{ (lb per sq in.)} = 635\ V \sqrt{\frac{1}{100 + \frac{D}{t}}} \quad \text{(28)}$$

$$a \text{ (fps)} = 47200 \sqrt{\frac{1}{100 + \frac{D}{t}}} \quad \text{(29)}$$

also from Equation 17

$$p \text{ (lb per sq in.)} = \frac{Va}{74.5} \quad \text{(30)}$$

The foregoing analysis has been based upon the assumption that the valve closure occurred instantaneously, which is impossible due to the physical construction of ordinary methods of closure. Furthermore, the derivation of the excess pressure and velocity formulas reveals that both are independent of the length of the pipe. In addition this brings out the fact that water hammer starts at the instant the closing of the valve begins but is not apparent unless complete stoppage of flow occurs prior to the time required for the inertia pressure wave to travel upstream and back again to the closing valve. In other words if $T = \frac{2L}{a}$ the excess pressure will be the same as that which would have occurred due to instantaneous closure.

To illustrate the use of these equations for determining when conditions will lead to water hammer, and, if so, what excess pressure will be produced in the pipe, consider a 6-in. standard weight steel pipe having an equivalent length of 800 ft in which the flow is 500 gpm.

Since $D = 6.025$ in. and $t = 0.280$ in.

$$a = 47200 \sqrt{\frac{1}{100 + \frac{6.025}{0.280}}} = 4250 \text{ fps.}$$

$$\text{Also } Q = 500 \text{ gpm} = \frac{500}{60 \times 7.5} = 1.11 \text{ cu ft per sec.}$$

$$\text{Then } V = \frac{1.11 \times 4 \times 144}{3.14 \times (6.025)^2} = 5.61 \text{ ft per sec.}$$

Substituting in Equation 28

$$p = 635 \times 5.61 \sqrt{\frac{1}{100 + \frac{6.025}{0.280}}} = 321 \text{ lb per sq in.}$$

also from Equation 30

$$p = \frac{5.61 \times 4290}{74.5} = 321 \text{ lb per sq in.}$$

This pressure will be exerted on the pipe wall if the closing of the valve takes place in less time than

$$T = \frac{2L}{a} = \frac{2 \times 800}{4250} = 0.377 \text{ sec.}$$

On the other hand, if the length had been 8000 feet, T would be 3.77 seconds; and under certain conditions it is conceivable that the valve could be closed in less time than this, thereby resulting in the full effect of instantaneous closure. Assuming that it is desired to limit the increase in pressure to 100 lb per sq in. then the closing of the valve must be retarded.

The relationship between the intensity of increased pressure due to water hammer and the time required to effect a complete cycle of the pressure wave was elaborately investigated for long pipes by Joukovsky and his deductions and analysis have been reported in the Proceedings of the American Water Works Association.

$$T_{100} = 0.377 \times \frac{321}{100} = 1.21 \text{ sec.}$$

In the case of the 8000-ft pipe, the minimum time in which the valve may be closed so as to limit the excess pressure to 100 lb per sq in. will be 12.1 sec.

Table 6 sums up the calculations for standard pipe sizes ¾ in. to 12 in. of Schedule 40 black steel pipe through which water is flowing at the rate of 5.0 fps when a valve is closed suddenly. The results in this tabulation clearly show the effect of water hammer in relationship to a given velocity of flow. It appears that the velocity of the pressure wave and the intensity of the increase in pressure due to water hammer are relatively constant for the range of diameters shown, there being a difference of only 13% between the values for ¾-in. pipe and 12-in. pipe. Consequently, it may be stated that the rate of propagation of the increased energy wave is 4400 fps and the increase in intensity of pressure is 300 lb per sq in. It may further be deduced that this increase in inertia pres-

Table 6 — Characteristics of Water Hammer in Schedule 40 Black Steel Pipe for a Velocity of Flow of 5.0 FPS

Nominal Diameter of Pipe, In.	I.D. of Pipe, D, In.	Thickness of Pipe Wall, T, In.	Velocity of Wave Travel, A, Fps	Increase in Pressure, P, Lb per Sq In.	Min. Time of Valve Closure in Seconds, for Pipe Length, L, of		
					500 Ft	1,000 Ft	10,000 Ft
¾	0.824	0.113	4560	306	0.219	0.438	4.38
1	1.049	0.133	4550	305	0.220	0.440	4.40
1¼	1.380	0.140	4510	303	0.221	0.442	4.42
1½	1.610	0.145	4480	301	0.223	0.446	4.46
2	2.067	0.154	4455	298	0.224	0.448	4.48
2½	2.469	0.203	4445	297	0.225	0.450	4.50
3	3.068	0.216	4410	295	0.227	0.453	4.53
4	4.026	0.237	4370	293	0.229	0.458	4.58
5	5.047	0.258	4320	290	0.231	0.462	4.62
6	6.065	0.280	4250	285	0.235	0.470	4.70
8	7.981	0.322	4230	284	0.237	0.474	4.74
10	10.020	0.365	4180	281	0.239	0.478	4.78
12	11.938	0.406	3980	267	0.251	0.502	5.02

sure is approximately equal to 60 lb per sq in· per ft of velocity of flow. In other words, the rate of flow, which is 5.0 fps, in being brought to zero, has resulted in an increase in pressure within the pipe of 300 ÷ 5 or 60 lb per sq in. for each foot of the original stream velocity destroyed.

Piping Materials

The service requirements for cold water systems pertaining to process or industrial piping are extremely liberal. There are no high temperatures or pressures that demand attention such as are needed in power piping installations; hence A.S.T.M. specification A-120 may be used satisfactorily. This classification is the lowest grade designated by the American Society for Testing Materials. No physical or chemical characteristics are specified and it has the smallest allowable stress of any steel pipe, the *S* value being only 8800 lb per sq in. for lap welded, 6500 lb per sq in. for butt welded and 10,800 lb per sq in. for seamless at temperatures not exceeding 150F.

This means that no particular attention need be paid to the selection of pipe for cold water systems in industrial plants as far as the material and manufacturing methods are concerned. It has been found more satisfactory to specify pipe according to the A.S.T.M. designation than to prepare an individual specification unless extraordinary conditions exist; and even then it is infinitely less troublesome and more definite to select some other standard specification which contains the special characteristics required. Suppose it is necessary to install pipe bends on an overhead cold water system due to the fact that the variation in the surrounding temperature produces sufficient expansion in the pipe to justify this means of absorption. Examining the several A.S.T.M. specifications, it is seen that Designation A-53 has a tensile strength of 45,000 to 60,000 lb per sq in. and an allowable *S* value of 6750 to 15,000 lb per sq in. at a temperature up to and including 150F and is suitable for bending and coiling. Pipe of this specification can therefore be used for fabricating pipe bends. Since both A.S.T.M. designations A-120 and A-53 are made in black and hot dipped zinc galvanized, it does not seem necessary to go beyond these two specifications for all cold water piping. Both grades can be furnished butt-welded in sizes up to 4 in.; lap-welded in sizes 1¼ in. to 12 in.; and as seamless in all sizes.

Because cold water piping is generally installed with galvanized pipe, the type of joints which may be used is limited to either screwed or flanged with flanged joints usually being specified for pipe sizes larger than 2 to 2½ in. diameter. During the war years, when the use of galvanized material was restricted, many industrial piping systems were installed with black steel pipe, especially for process systems, and welded joints used instead of flanged joints. Where flanged joints were normally provided at valves and equipment, welding-neck, or slip-on flanges were used in connection with all-welded construction of the piping system. Black steel pipe still has its place in process water systems where space around equipment is restricted. Such fabricated headers at pumps, etc., can be hot-dipped after welding if this is deemed necessary. Where flanges are used on galvanized pipe, they are usually of cast iron, whereas on welded lines they must be steel. Screwed fittings on smaller lines may be malleable iron or cast iron.

In the selection of valves for cold water service, it is customary to use valves having brass or bronze bodies and trim and of the non-rising stem type for the smaller sizes and iron body valves with brass trim for flanged valves up to 4-in. size beyond which valves of the O.S.&Y. pattern are recommended. In general, gate valves are used for sectionalizing and operating service where the valves are either open or closed; and for regulatory service, globe valves are specified. As discussed earlier in this article, caution must be exercised in the location and use of globe valves because of their excessive pressure drop particularly in the larger sizes. In some instances, they are employed as a definite controllable resistance in the line to equalize the pressure drop due to wide fluctuations in the rate of flow through the system.

Home Fuel Savings Gained by Insulation

The most profitable investment a homeowner can make is insulation of his ceiling.

Speaking at the seventh annual University of Illinois Conference on Coal Utilization, Prof. Warren S. Harris, heating research engineer at the University, said the return the average homeowner can expect from investment in ceiling insulation is 25% saving in fuel. This saving is for a typical two-story small house. For a one-story house the saving is even greater.

"Home insulation," Professor Harris said, "will pay for itelf in from four to eight seasons. Side wall insulation usually results in the greatest reduction in total fuel bill, but because of the higher cost of installation, the return on investment is somewhat less than for ceiling insulation."

Basing his figures on cost of insulation inserted during construction, he listed the following annual return to be expected on the investment made:

Wall insulation, 4 in., 17%
Wall insulation, 2 in., 18%
Ceiling insulation, 4 in., 25%
Ceiling insulation, 2 in., 21%
Storm sash and doors, 15 %
Weather strip, 9%.

Nomograph for Duct Sizing

NICHOLAS S. SHATALOFF

THE accompanying nomograph designed by the writer for duct sizing represents a nomographic solution of the following standard formulas used in designing air piping systems:

$$(1)\quad h_l = 1.1 \frac{L}{CD^{9/7}} \left(\frac{V}{4005} \right)^{13/7}$$

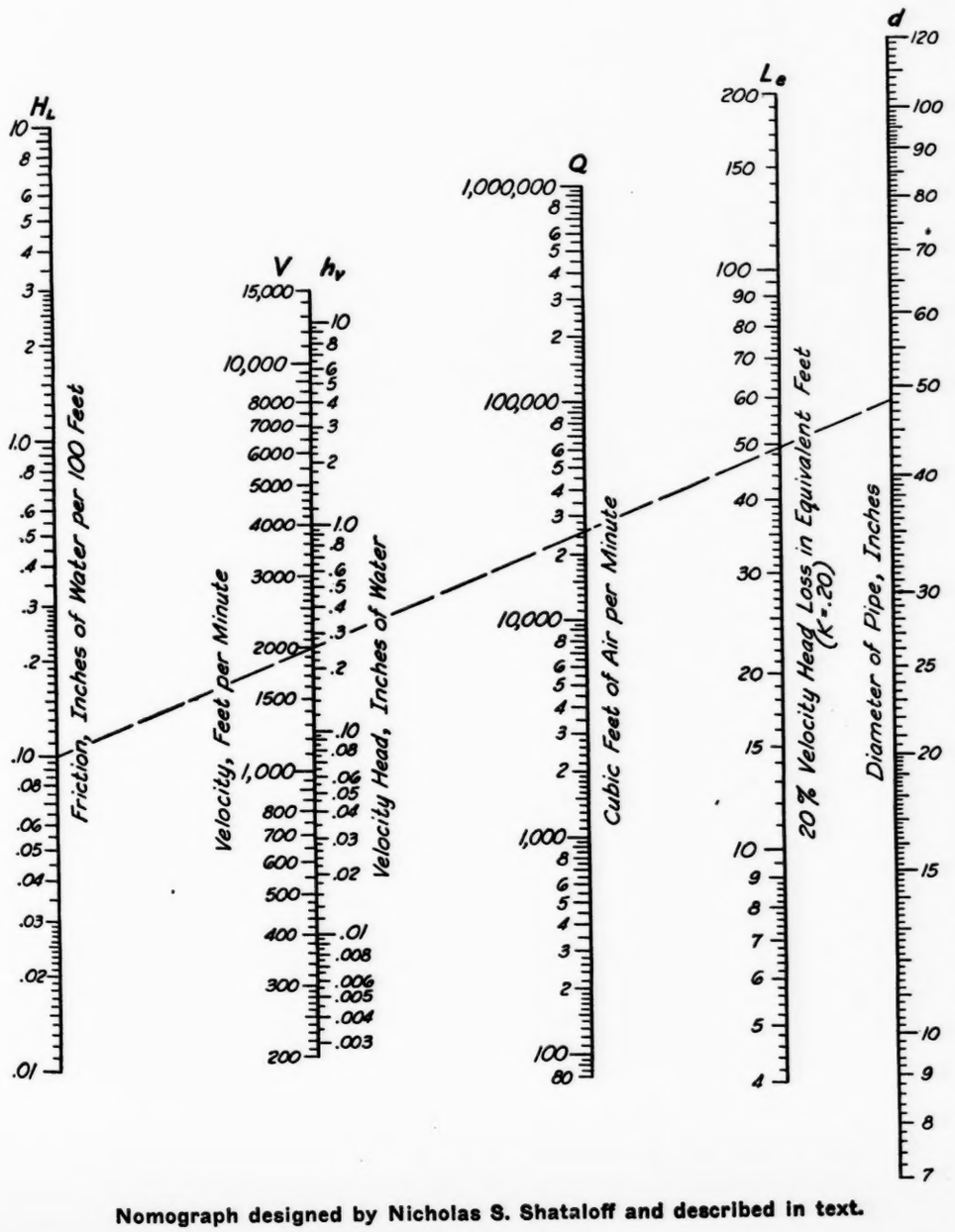
$$(2)\quad h_v = \left(\frac{V}{4005} \right)^2$$

$$(3)\quad Z_f = K \left(\frac{V}{4005} \right)^2$$

$$(4)\quad L_e = .91\ KCD^{9/7} \left(\frac{V}{4005} \right)^{1/7}$$

where

h_l = friction in inches of water,
L = length of pipe in feet,
V = velocity of air in feet per minute,
C = 50,
D = diameter of pipe in feet,
h_v = velocity head in inches of water,
Z_f = loss of head in fitting in inches of water,
K = .20, and
L_e = velocity head loss in equivalent feet.



Nomograph designed by Nicholas S. Shataloff and described in text.

The general rule to follow in using the nomograph is: Join any two known quantities by a straight index line and read the unknown quantities on intersection of index line and corresponding scale.

Example

Given h_l = .10 in. of water per 100 ft, Q = 25,500 cfm.

Solution. Locate the friction (.10) on the extreme left scale, and the volume *Q* (25,500) on the center scale. Connect by a line, and read

V = 2000 fpm, h_v = .25 in., L_e = 49.2 ft, and d = 48.4 in.

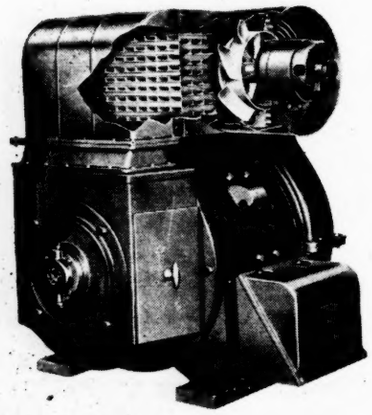
Scale h_v can be used in estimating dynamic losses in fittings directly in inches of water. Scale L_e gives similar values expressed in equivalent feet. It should be noticed that scale L_e is plotted for 20% velocity head loss (K = .20); thus it can be used directly for estimating losses in average elbows. For special fittings the value as read on scale L_e should be multiplied by a corresponding ratio of *K* constants. Consequently, for a miter elbow in the foregoing example,

$$L_e = 49.2 \times \frac{.87}{.20} = 214 \text{ ft.}$$

NEWS OF EQUIPMENT AND MATERIALS

D-C Motors

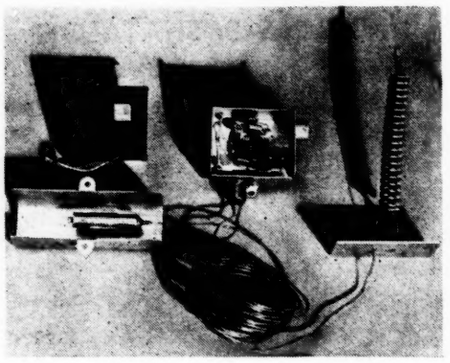
NAME—G. E. unit cooled d-c motor.
PURPOSE—D-c motor for operation under severe atmospheric conditions.
FEATURES—Unit cooler has two sets of air passages arranged at right angles to each other. Fan on the motor armature circulates air through the motor and through one set of passages forming an enclosed system. External air, moved by an auxiliary motor and fan, travels through the other set of passages to absorb heat from the enclosed system. Totally enclosed construction is obtained without external duct work or piping. A thermo-



static relay in the airstream of the enclosed system protects the main motor in case of failure of the auxiliary motor. Motors can be furnished with ball or sleeve type bearings. Motors are also available with several types of windings.
LITERATURE AVAILABLE—GEA 4469.
MADE BY—*General Electric Co., Schenectady, N. Y.* **195**

Limit Control

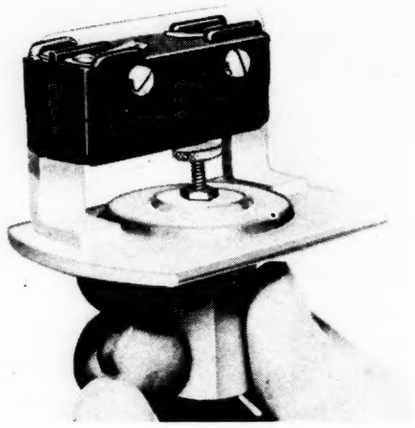
NAME — T 418 compensated limit control for domestic heating plants.
PURPOSE—Designed for use with the volume method of Moduflow system of temperature control in homes. Also suitable for use with some forms of panel heating and



the conventional thermostat method of heating control.
FEATURES—Control consists of a mercury switch instrument case and two capillary tubings and bulbs. One tube is 20 ft long so that the bulb may be mounted outside the house exposed to outdoor temperatures. The other tube, 10 ft long, is installed on the bonnet or warm air supply of a furnace. As the outdoor temperature falls below 65F, the temperature in the furnace is raised according to a predetermined schedule.
MADE BY—*Minneapolis-Honeywell Regulator Company, Minneapolis, Minnesota.* **196**

Special Device Switch

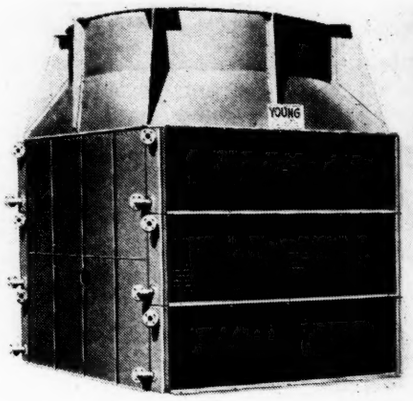
NAME — Cook SD special device switch.
PURPOSE — For transforming



mechanical impulses into electrical and actuating a wide variety of devices. Can be used with any gas or liquid for such purposes as controlling pressure of steam boilers, pressure cookers and air spaces; for monitoring heating elements; and for turning on or off fans in heating, ventilating or air conditioning systems.
FEATURES — Steel stud is copper furnace-brazed to a steel base for rigidity and strength. Bellows of tinned phosphor-bronze. Pipe sizes optional on quantity orders but is ¼ in. standard female pipe thread on standard unit.
SIZES AND CAPACITIES—Operates on pressures from 1 to 17 lb per sq in. Pressure differential is held to close tolerance. Circuit can be supplied single pole-single throw, normally closed, or single pole-double throw.
MADE BY — *Diaphlex Division of Cook Electric Company, Chicago 14, Illinois.* **197**

Cooling Radiator

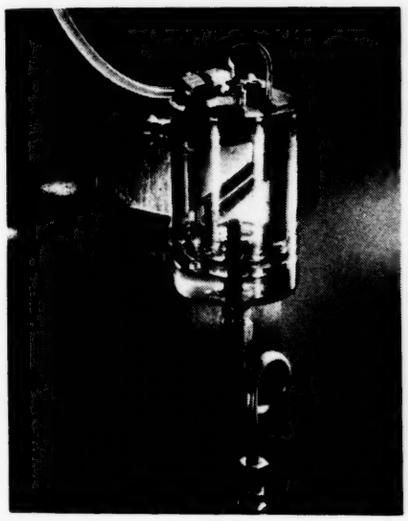
NAME—Young series VAD-10 cooling and condensing radiator.
PURPOSE—Large capacity cooling and condensing radiators.



FEATURES—Cooling faces are located on the opposite sides of unit to permit line installation of several units where large capacities are required. Fan and drive assembly is mounted independent of main unit assembly. Unit has a low speed fan. Coils are mounted in a vertical plane for economy and protection from the weather.
MADE BY—*Young Radiator Co., Racine, Wis.* **198**

Float Control

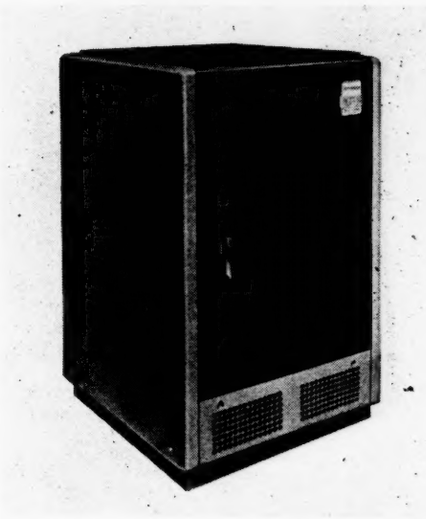
NAME — Float control for furnace humidifier.
PURPOSE—For controlling water level in humidifying units.
FEATURES—Leading into the plastic cup through the lid is a water inlet which is controlled by a self-flushing diaphragm valve. Rate of drip feeding from this inlet equals the rate of evaporation in the pan, which is regulated according to the desired degree of humidity. Valve automatically closes when water level rises to within 3/8 in. of top of pan in furnace. If grit is present on the valve set the level rises slightly higher and the surplus goes out the bottom of the cup to an



overflow tube. A Tenite bell float maintains the water level for which the control level is set.
MADE BY — *Cleveland Humidifier Co., Cleveland, Ohio.* 199

Gas Boiler

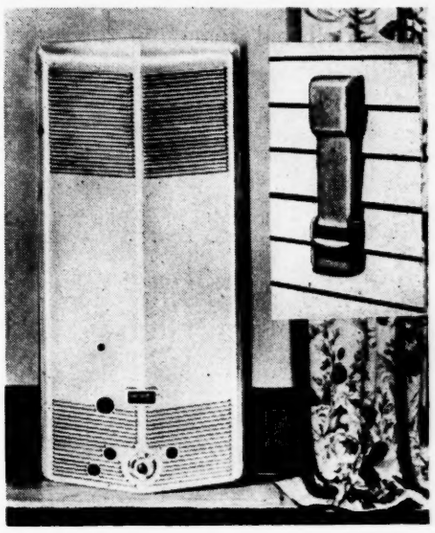
NAME—Empire gas boiler.
PURPOSE—Residential space heating by gas.
FEATURES—All control functions are centered in the Thermotor throttling valve which controls the gas flow to maintain proper room temperature. The burner is a raised, drilled port, Bunsen burner which is said to be quiet in operation. Several models have water filled sections completely surrounding the



combustion chamber to prevent excess radiation to the floor. Boilers are designed for steam or hot water heating.
MADE BY—*American Radiator & Standard Sanitary Corp., Pittsburgh 30, Pa.* 200

Gas Heater

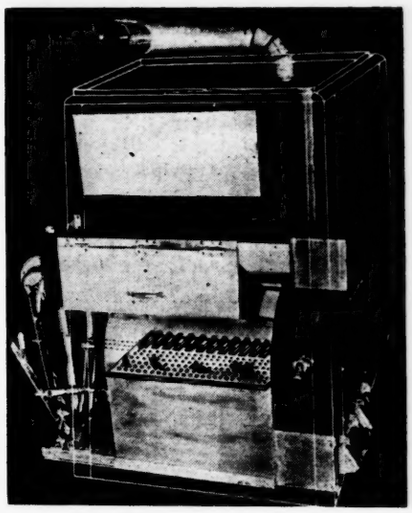
NAME—Saf-Aire.
PURPOSE—Space heating.
FEATURES—Gas fired unit is designed for individual room use and is available with thermostat control. It is installed between the



studs of an outside wall and draws air directly from the outside for combustion. Fumes are discharged to the outside. A specially designed vent, shown in insert of photograph, is said to assure proper draft for combustion at all times regardless of direction or turbulence of air currents. This vent which protrudes 2 in. from the outside wall is used to supply air and to expel the products of combustion.
SIZE AND CAPACITY—Heater comes in two sizes—10,000 and 20,000 Btu per hour.
MADE BY—*Heating Research Corp., Muncie, Ind.* 201

Smokeless Furnace

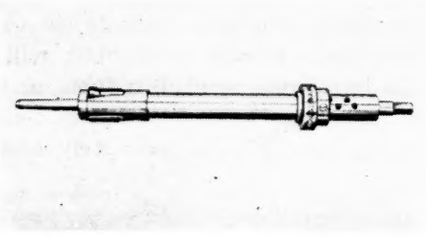
NAME—Worsham one-minute smokeless furnace.
PURPOSE—House heating.
FEATURES—Furnace is designed to burn high volatile coals, but will also burn coke, smokeless fuels, and anthracite. Grate is made in two parts, each hinged separately and



operated by a different lever. Moving one lever dumps the ashes into an ash pan below. After grate swings back into place, by pulling another lever, the live unconsumed coals are moved onto the first grate. This leaves the second grate free to receive fresh coal from the overhead bunker which is filled once a day. No coal remains in the chute which connects the hopper to the combustion chamber. Rate of combustion is controlled by thermostats which operate two drafts.
MADE BY—*Worsham Co., Inc., 7329 Lohmeyer Avenue, St. Louis 17, Missouri.* 202

Tube Expander

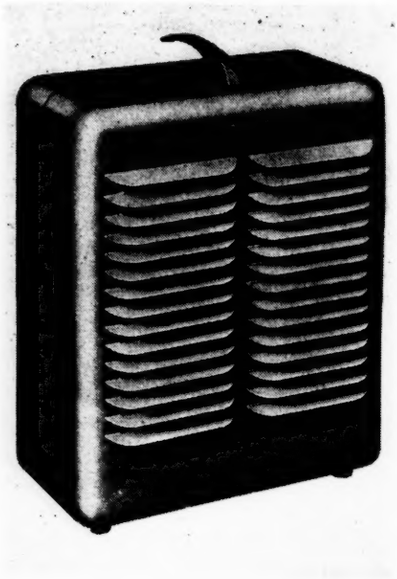
NAME—Dudgeon special arch tube expander.
PURPOSE — For making repairs where boiler construction makes ordinary retubing methods impossible.
FEATURES—Tube is designed to roll the far ends of tube into the tube sheets in installations where no provision is made to gain entry for readily rolling the tubes. Expander enters from the smoke box or fire door and reaches through the whole length of tube to roll the far end. A revolving stop collar on frame extension permits adjustment for



various lengths of tubes. Expander is furnished with tapered and flaring rollers so that tubes may be flared as well as enlarged or with tapered rollers for expansion only.
MADE BY—*Richard Dudgeon, Inc., 24 Columbia Street, New York 2, New York.* **203**

Electric Heater

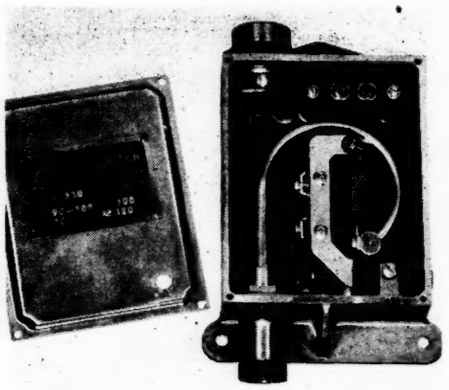
NAME — Thermador electric heat fan.
PURPOSE—Space heating.
FEATURES—Heat is drawn off the circular heating coils by a four-bladed fan and forced out through a horizontal grille. With the heating element switched off, the fan may be operated to circulate cool air in summer. Unit weighs 19½ lb and is available with thermostatic control or with rotary range type for position switch which controls full heat, half heat, cool fan, and off. A thermostat on the heating unit breaks the circuit if something prevents delivery of air to heater. Unit is designed for use in factories, shops, warehouses and garages.



SIZES AND CAPACITIES — Available in 3,000, 4,000 and 5,000 watts capacity.
MADE BY — *Thermador Electrical Manufacturing Co., 5119 District Blvd., Los Angeles 22, Calif.*.....**204**

Pressure Operated Switch

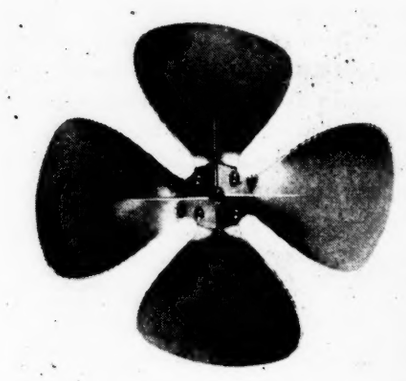
NAME—Meletron series 310 pressure operated switch.
PURPOSE—For switch designed to operate at a prefixed pressure.
FEATURES—Unit is designed to operate within a range of 20 to 3,000 lb per sq. in. Switch may be adjusted without removing the cover of the case. Incorporated in the



unit is a Micro switch with a ratio of 10 amps at 125 volts.
MADE BY—*Meletron Corp., 950 No. Highland Avenue, Los Angeles 38, Cal.* **205**

Fan Blade

NAME—Motionair fan blade.
PURPOSE—To provide a blade capable of quietly moving a large volume of air.
FEATURES—All four blades are fabricated from a single die so that pitch and profile are identical for all blades. Creasing is designed to give blades greater rigidity.



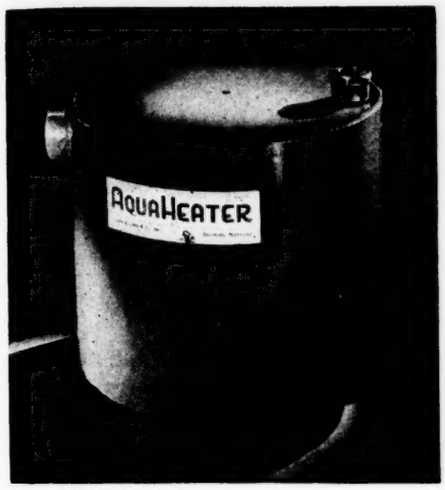
Should one of the blades become damaged, only the damaged blade need be replaced, not the entire fan.
MADE BY — *Motionair Co., 9242 Beverly Boulevard, Beverly Hills, Calif.* **206**

Adhesive

NAME—518 Fairprene adhesive cement.
PURPOSE — For bonding Buna-N synthetic rubber and vinyl sheets to steel, aluminum, glass, wood or concrete.
FEATURES—Adhesive is a thermoplastic synthetic that does not require vulcanization to obtain maximum adhesive strength. While aromatic hydro-carbons will destroy the bond, it will weaken only slightly with oils or straight gasoline. Although it is unaffected by temperatures as low as 40F, its adhesive strength is weakened at 160F and higher. Full bond strength, however, is regained after cooling to normal temperatures.
MADE BY—*Fabrics Division, E. I. du Pont de Nemours & Co., Fairfield, Conn.* **207**

Water Heater

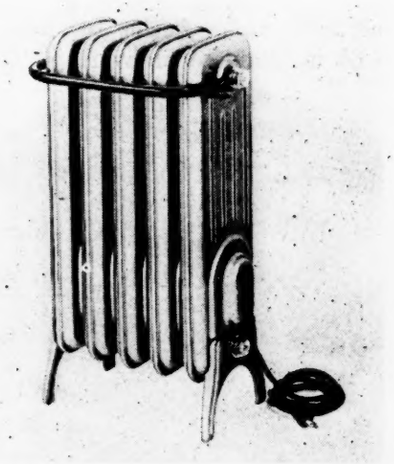
NAME—AquaHeater.
PURPOSE—For heating domestic hot water.
FEATURES—Unit is attached to the outlet pipe of a hot water or steam boiler. Coil of copper tubing is installed inside a steel shell. Only boiler water comes in contact with the steel shell. This heater is not recommended by the makers for installation in territories where the water contains lime.
SIZES AND CAPACITIES—With boiler



water at 180F, and the domestic hot water heated from 40 to 140F, capacity of heater is 5 gpm.
LITERATURE AVAILABLE—Illustrated folder.
MADE BY—*Joseph E. Lewis & Co., Inc., Baltimore 30, Md.* **208**

Electric Radiator

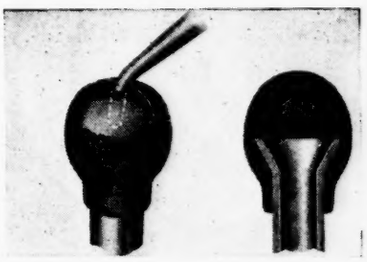
NAME—MORTON Co-Z-Air portable electric radiator.
PURPOSE—Space heating.
FEATURES—Elements are completely enclosed. No water or steam is used in the operation of unit Heat is not only radiated from the unit but cold air is drawn in off the floor, passed through the radiator and circulated into the room through concealed vents in each section of radiator. Carrier handle can also serve as a drying rack for towels.
SIZE AND CAPACITIES—New models of 800 to 1320 watts, available in



5 and 8 sections, have output of 2600 and 4300 Btu, respectively.
MADE BY—*Henry H. Morton Associates, Inc., 516 Boulevard Building, Detroit, Mich.* **209**

Cap for Oil Tubes

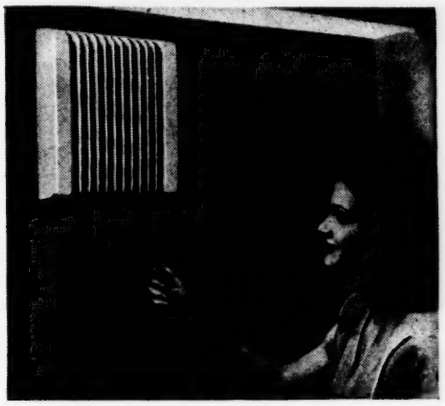
NAME—Self-sealing cap for oil tubes.
PURPOSE—To permit easy oiling.
FEATURES—Cap is made of molded synthetic Buna N and is applied to the slightly flared end of an oil tube or oil line. It is permanently fastened by a combination of mechanical fit and synthetic cement and is positioned by an internal shoulder that rests on the flared end of the tube. The cup holds a supply of oil for slow seepage to the bearings



which means that less frequent oiling is required. Dust and dirt are excluded by the tight sealing of the cap when the oil is removed.
SIZES AND CAPACITIES—Caps are available for oil tube sizes from ⅛ to ½ in. O.D.
MADE BY—*Eynon-Dakin Co., 1847 West Bethune Avenue, Detroit 6, Michigan.* **210**

Kitchen Ventilator

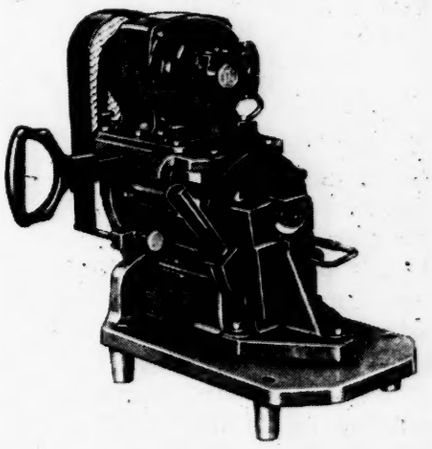
NAME—Aeropel.
PURPOSE—Kitchen ventilation.
FEATURES—A plastic 12 x 12-in. grille is used in this unit designed to offer a minimum of resistance to air flow. A 3-bladed propeller type fan is driven by a totally enclosed constant speed motor. Ven-



tilator has rated capacity of 400 cfm.
MADE BY—*American Blower Company, Detroit 32, Michigan.* **211**

Tube Cutter

NAME — Electric tube cutting and flaring machine.
FEATURES—Designed to cut, flare, and trim copper or aluminum tub-



ing in one operation. There are removable jaws for various sizes of tubing. Motor is 1/3 hp.
MADE BY — *C. J. Unger Manufacturing Co., Dayton 10, Ohio.* **212**

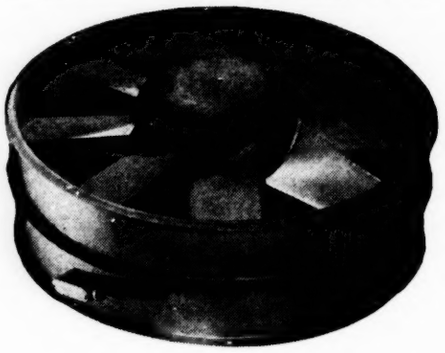
Offset Joints

NAME—MagniLastic offset joint.
PURPOSE—Flexible unit for joining pipe terminals that are out of line.
FEATURES—Offset joint is constructed with an equal number of expansion flanges on either end of an insert section. The length of unit and the number of flanges are determined by misalignment condition to be corrected. Joints are supplied with bellow flanges from

any of the MagniLastic standard expansion joint series which includes pressures from vacuum to 1,000 lb per sq in. End fittings are available in welding end or Van Stone bolted flanges.
SIZES AND CAPACITIES—Pipe sizes from ½ to 24 in. stainless steel, monel, Inconel and copper.
LITERATURE AVAILABLE — Catalog containing data on the offset joint.
MADE BY—*MagniLastic, a Division of Cook Electric Co., 2700 Southport, Chicago 14, Ill.* **213**

Blower

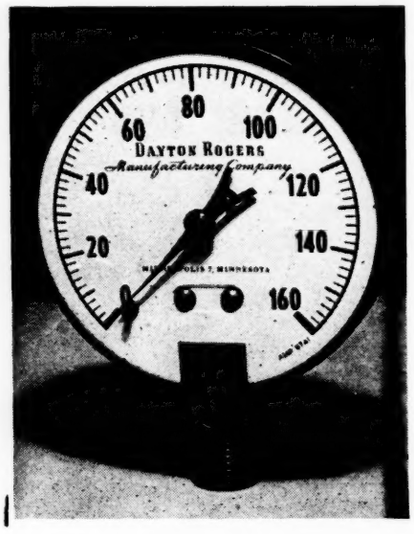
NAME—Moore direct drive axial flow pressure blower.
PURPOSE—Industrial ventilation.
FEATURES—Unit is of fabricated monel metal construction incorporating spherical hub and ring construction. Although monel has been adopted as standard, it can also be supplied in stainless steel or aluminum. The weatherproof nonoverloading direct drive motor is furnished in speeds from 300 to 1800 rpm, and from 1 to 60 hp. Motors are placed on synthetic rubber shock mounts.
SIZES AND CAPACITIES—16-in. hub and 24-in. hub. Series 16 from 36 to 60 in. diameter delivering up to



40,000 cfm at static pressures up to 4 in. water.
LITERATURE AVAILABLE — 16-page illustrated booklet.
MADE BY—*The Moore Company, 544 Westport Road, Kansas City 2, Missouri.* **214**

Pressure Gauge

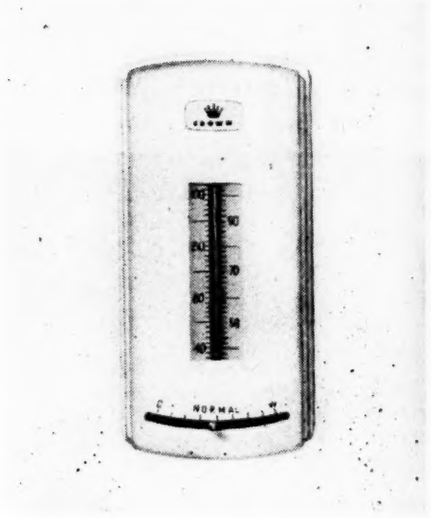
NAME — Dayton Rogers pressure gauge.
PURPOSE—Measurement of pressure.
FEATURES—Instrument has a nonbreakable crystal of convex layout. Dial is lettered in contrasting letters with easy reading graduations.



Gauge, of the Bourdon type, is suitable for use with any liquid or gas. Movement is constructed to absorb shocks from severe uses.
MADE BY—*The Dayton Rogers Mfg. Co., 2835 12th Ave. S., Minneapolis 7, Minn.* **215**

Thermostat

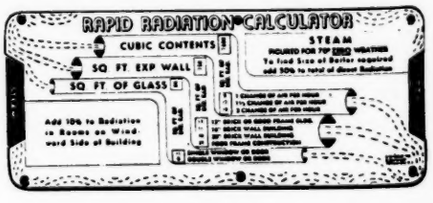
NAME—Tempmaster thermostat.
PURPOSE—Temperature control.
FEATURES—At top center of instrument through a thin part of the shell covering, an electric light signals when the dampers are closed completely. A dim light indicates



when motor is in operation during process of changing dampers. A bright light indicates when the dampers are open, and no light shines when dampers are closed completely. Contacts are so designed as to reduce heating of contact faces.
MADE BY—*Crown Controls Co., New Bremen, Ohio.* **216**

Radiation Calculator

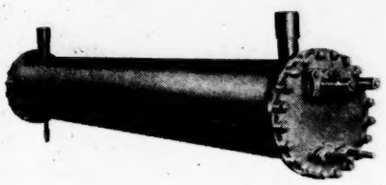
NAME—Rapid radiation calculator.
PURPOSE—A sliding scale to simplify radiation calculation.
FEATURES—Made of plastic, scale



measures 7 x 3 in. It shows the amount of steam, hot water and warm air radiation required for rooms, houses and other buildings.
MADE BY—*Smithson Co., Box 467, Derby, Conn.* **217**

Water Chiller

NAME—Model DXG direct expansion water chiller.
PURPOSE—Heat exchanger for the production of chilled water.
FEATURES—The new heads for 12¾ in. diameter or larger are designed for two even refrigerant circuits although single circuit arrangements are also available. Water is circulated around the tubes and the



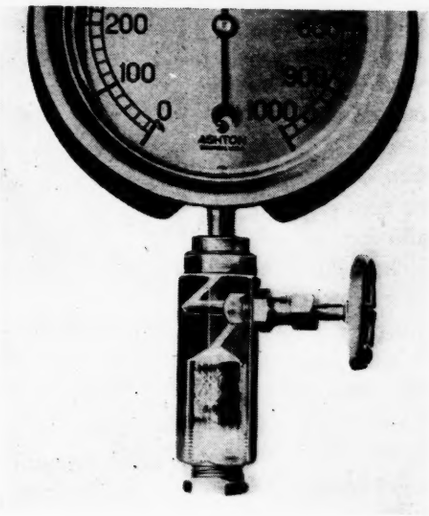
flow of water through the shell is controlled by a baffle arrangement in the shell. Refrigerant control is obtained by a thermostatic expansion valve. A new design of tube expansion is used to reduce the possibility of leakage.
MADE BY—*Acme Industries, Inc., Jackson, Mich.* **218**

Small Synchronous Motor

NAME—Kurman self-starting small synchronous motors.
PURPOSE—For timing devices and controls and similar applications.
FEATURES—Gears are enclosed in die-casting which supports bearings and seals in the lubricant so that no re-oiling is required. Provides great increase in torque without increasing iron and copper weight.
SIZES AND CAPACITIES—Can be furnished for voltages from 1 to 250 and frequencies from 25 to 125 cycles; direction of rotation may be either clockwise or counterclockwise. Overall size is 2 x 2⅜ x 1 ¼ in., weight 9 oz. Requires input of only 1½ watts and produces starting and synchronous running torque of 10 inch-ounces at 1 rpm.
MADE BY — *Kurman Electronics Corp., 130 Clinton St., Brooklyn, N. Y.* **219**

Pulsation Dampener

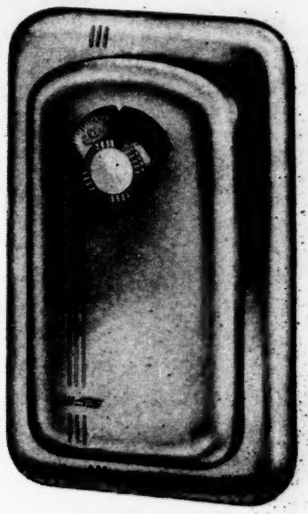
NAME—Micro-Beam.
PURPOSE—For dampening pulsations of gauges and governors.
FEATURES—To overcome the possibility of scoring, a small diameter passageway is controlled by a screw which, when turned slightly,



is said to bring back the seating to perfect control. Unit is made in brass or steel with stainless steel stem.
SIZES AND CAPACITIES—Comes in ¼, ⅜ and ½ in. sizes and for pressures up to 6,000 lb.
MADE BY—*J. A. Campbell Co., 645 E. Wardlow Rd., Long Beach 7, Calif.* **220**

Room Thermostat

NAME—CD109A Cam-Stat.
PURPOSE—For controlling heat.
FEATURES — All current carrying parts are enclosed within the bakelite housing behind the wall plate. It extends less than one inch from the wall. Unit can be used for either line voltage or low voltage currents. Temperature range is 50-100F with a differential of 2-3F. Switching



arrangements are SPST break or make on temperature rise, SPDT and independent circuit double throw.
MADE BY—*Cam-Stat, Inc., 2037 South La Cienega, Los Angeles, Calif.* **221**

November, 1946

TO OBTAIN FURTHER INFORMATION ON NEW EQUIPMENT

On the list below, circle the item number of the equipment in which you are interested, using the number found at the end of each item.

195	196	197	198	199	200	201	202	203
204	205	206	207	208	209	210	211	212
213	214	215	216	217	218	219	220	221

Print your name and address, detach and mail to
Editor, HEATING AND VENTILATING, 148 Lafayette St., New York 13, N. Y.

Name .....

Title (Must be shown) .....

Firm (Must be shown) .....

(For prompt service, title and firm name must be shown above.)

Business Address ....

City..... Zone..... State.....11/46

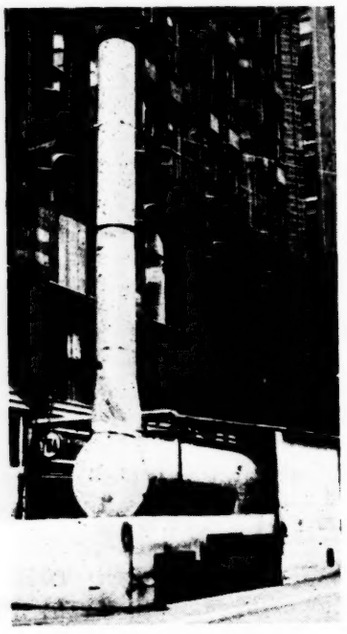
NEWS OF THE MONTH

POWER STRIKE

creates unusual heating problem in downtown Pittsburgh as district heating workers walk out.

The strike of Pittsburgh's electric power workers created an unusual heating situation, as the greater part of downtown Pittsburgh is heated by the Allegheny County Steam Heating Co. whose workers, belonging to the same union, also went out on strike. Supervisory personnel maintained service until the coal supply was exhausted owing to refusal of delivery trucks to cross union picket lines.

• **EMERGENCY BOILERS.** — The absence of central heating service from October 2nd to 17th necessitated the installation of all types of heating devices ranging from kerosene burner stoves to oil and coal boilers. Many of the large office buildings were able to heat their buildings by installing boilers on the outside of their buildings in adjoining lots or in the streets.



Union Trust Bldg. boiler fired with natural gas.

The city issued special boiler permits during this emergency. Field locomotive type steam boilers were located, leased, transported to the city and erected. In three cases regular steam locomotive engines were parked on tracks alongside of buildings and steam connections made between the domes of the boilers to the steam heating mains in the buildings.

In some cases, new steel boilers were purchased and installed. The boilers installed were fired with either coal, natural gas, or oil. Some of the outdoor type boilers were made to operate quite smokelessly with low grade coal by having special over-fire jet provisions made in the firebox.

The emergency boilers were tied into buildings by steam mains running through doorways, or through holes made in walls or sidewalks.

While these temporary installations did heat the buildings sufficiently in mild weather, their capacity would not have been great enough for winter demands.

• **SERVICE RESUMED** — When delivery of coal was resumed to the central heating plant because the truck drivers' union decided to ignore the company union picket lines, steam heating service was brought back by the supervisory workers.

Gimbels leased 100 hp coal fired boiler and set it up in 6th Street.

The use of emergency boilers was discontinued as soon as regular service was turned on. In some cases new boilers were in the process of erection and never put into actual heating service. The boilers will remain in place and connected until the owners are assured that there will be no recurrence of another shutdown.

AIR CONDITIONING

provided for all public spaces on new U. S. ships in trans-Pacific trade. Other parts are ventilated.

Air conditioning is becoming increasingly important in the transportation field. Railroads began installing air conditioning 12 years ago on their important trains. It has since spread to buses and airplanes and now to ocean liners.

• **FIRST.**— Although some passenger ships now in operation have air conditioning in varying degrees, the first vessels to have complete installations, including thermostatic control in staterooms, are now under construction in Alameda, Calif. These liners, being built by the Bethlehem Steel Co. for the trans-Pacific passenger-cargo trade of the American President Lines, will have perhaps the largest comfort air conditioning plants ever installed on board ship.

Each of the ships, designed by George G. Sharp, New York naval architect, will have accommodations for approximately 550 passengers. One, the S.S. President Cleveland, has been launched and the launching of the other, the S.S. President Wilson, is set for an early date.

Working with the Aetna Marine Corp., which is constructing the interiors, the Minneapolis-Honeywell

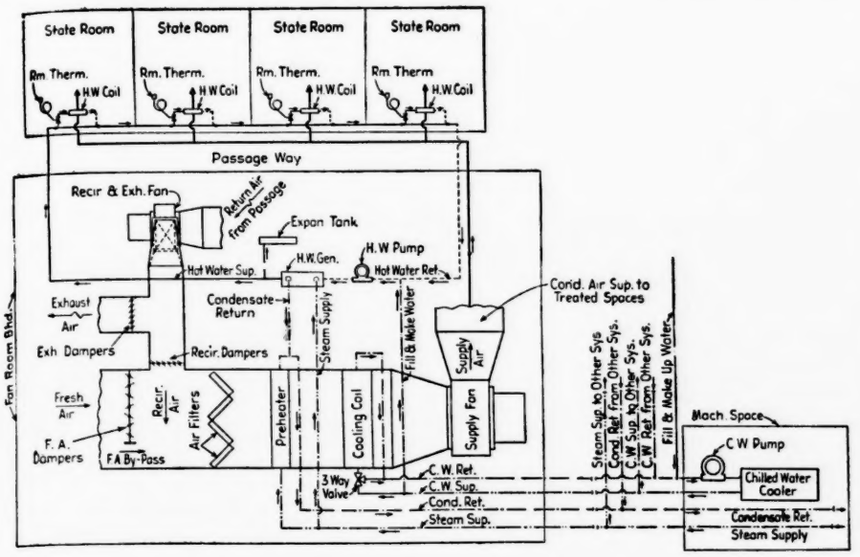


Fig. 1. Class "D" system designed for 81F, 50% RH.

Regulator Co. and Carrier Corp. have provided air conditioning for all cabin and tourist class passenger staterooms, foyers, lobbies, public spaces, concessionaires and crew's staterooms. Messrooms and recreation rooms for the officers and crew also are air conditioned.

• **DESIGN.**—The systems are designed for an outside summer dry bulb temperature of 95F and 80F wet bulb. Heating facilities are based on an outside winter temperature of 0F. The cooling and heating loads are established on the basis of the most severe port weather conditions.

All of the systems are designed to provide the same effective temperature for all spaces, 74 degrees. In order to achieve economical selection of equipment, however, it has been necessary to provide a slight variation in the actual design room dry bulb temperature and maximum relative humidity for the several different classes of systems.

For example, large public spaces, served by systems known as Class "A," are designed for 80F dry bulb and 55% relative humidity. Tourist Class and other small spaces served by Class "D" systems, Fig. 1, are designed for 81F dry bulb and 50% relative humidity. Cabin Class staterooms and other spaces served by Class "E" systems, Fig. 2, are designed for 82F, and 40% relative humidity. The apparatus dew point of all Class "A" and "D" systems is about 58F.

• **AIR SUPPLY.**—Cabin class state rooms will be supplied by air conditioning units in fan rooms provided with suitable controls. The air, preconditioned for humidity control, will be dispensed by the Carrier Weathermaster high pressure system to individual cabins. Thermostats in each room will operate a modulating three-way valve to control the temperature in the hot and cold water coils.

Air conditioning for tourist class cabins is designed similarly, except that the primary air is dehumidified, preheated or precooled in the main unit. Again the passenger can regulate the temperature by operating the room thermostat which adjusts the three-way modulating water valve on the hot water terminal unit.

Public spaces, such as verandas, lounges and club cabins, have individual main units, with no booster heaters or coolers on the ends of branch ducts.

• **UNIT COOLERS.**—The captain's cabin has the same equipment as first class cabins. Officers' and stewards' cabins have ventilated air, tempered through a master and submaster controller. In addition, there are cooling units with a cold water coil suspended from the ceilings of these spaces.

Entertainers and concessionaires will have the same kind of room air conditioning as provided in tourist class cabins. A central unit preheats and dehumidifies the incoming fresh air and the room is controlled by a thermostat, modulating a three-way water valve on the hot water coil in the terminal unit of each room.

In addition, mechanical ventilating is provided for virtually all the enclosed spaces of the ships. In general, the air supply to all uncooled spaces is required to equal 30 cfm for each occupant. In unoccupied spaces the air change varies from one complete change every two minutes in the battery room to a change every 30 minutes in dry cargo spaces. No space is to receive less than 25 cfm.

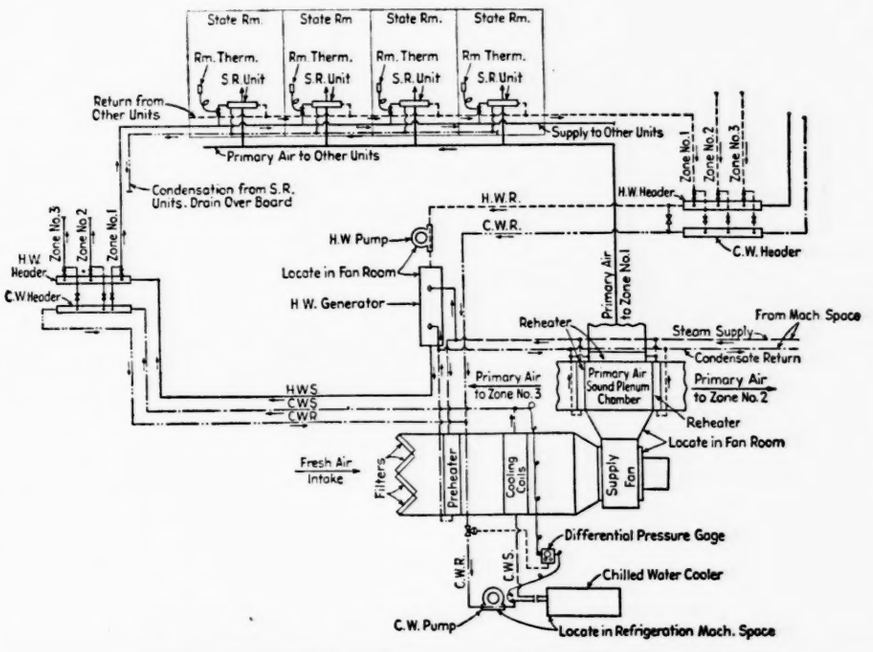


Fig. 2. Class "E" system designed for 82F, 50% RH.

END OF INFLATION

seen in 1947 by non-government economists – to be accompanied by mild recession with employment not seriously affected.

General commodity prices will reach an early peak and then turn downward in the opinion of a majority of 72 non-government economists participating in a survey conducted by F. W. Dodge Corporation. The group included economic consultants and economists connected with business corporations, financial institutions, universities, and various economic research organizations.

• **WHEN.** — Fifty-three of the economists expect the peak to occur and recession to start before the end of 1947. One expected it within 18 months, while 12 expected it after the end of 1947. A composite of the view on timing of the price and business recession follows:

Consumer goods would reach a price peak and turn down during the spring of 1947, building materials around the middle of 1947 and other durable goods in the second half of 1947. Eighteen of the economists expect the turn in consumer goods prices before the end of 1946. Two-thirds of the sample expect the consumer goods recession to last less than 12 months, 60% expect less than 12 months down swing in building materials prices, 55% expect less than a year of declining process in other durable goods.

• **HOW MUCH.**—Pointing out that the Bureau of Labor Statistics' index of wholesale prices of all commodities stood at 128.4 on August 24, the economists were asked to estimate the extent of such rise over that figure as they might anticipate by the end of 1946, and by the time the index reaches its anticipated peak.

Among the fifty-three anticipating a price peak before the end of 1947 the extent of rise in the general index to the end of 1946 was as follows: five anticipated a decline from the August 24 figure (128.4), eight anticipated zero increase over that figure, twenty-eight anticipated rises ranging from two to nine points, and seven anticipated a rise of ten points or more. The average of all the answers was about five points increase.

On the question of the number of points the general index would rise from August 24 to the anticipated 1947 peak, the answers were as follows: no increase, seven; increases ranging from two to nine points, sixteen; increases from ten to fifteen points, thirteen; increases of more than fifteen points, ten. The average of all the increases indicated was a little under ten points.

With regard to building materials prices, thirty-two of forty-two answers indicate a smaller percentage drop from the peak than would occur in general commodity prices. A number qualified this statement by saying the drop would be less if measured from the official price index (which registers OPA ceiling prices) but greater as measured from actual current prices being paid in the market.

The minority of twelve who expect the price peak after the end of 1947 naturally expect larger price rises than do those of the majority group. The average of increases to the end of 1946 expected by the minority is ten points, the average of expected rises to the price peak is about forty points.

As a general conclusion it may be stated a majority consider that commodity price inflation has very nearly run its course, while the minority expect it to continue into 1948 or beyond.

The six economists who refrained from specific answers to the questions asked, cited uncertainties in the foreign situation, domestic politics, government controls and union labor attitudes as reasons why no answers could be hazarded.

CONVECTOR STANDARDS

proposed by joint conference of manufacturers to eliminate confusion and expense of individual sizing.

The Convector Manufacturers Association, working in cooperation with the Institute of Boiler and Radiator Manufacturers, has prepared a tentative schedule of standard sizes for qualification as standards in the industry. The following outline of the proposed standard was presented before the fifth annual meeting of the Middle Atlantic Wholesalers Association by Albert J. Nesbitt, president of John J. Nesbitt, Inc.

• **NEED.**— The term "convector" is defined as describing a piece of heating equipment composed essentially of a heating element designed for hot water or steam circulation, enclosed within a sheet metal cabinet provided with an intake opening at the bottom and a discharge grille at or near the top, to differentiate this product from ordinary convector radiation. Mr. Nesbitt pointed out that heretofore manufacturers—in order to remain competitive in their offerings—have increased their lines to an almost fantastic number of sizes and combinations. It has not been unusual for any line to exceed 2,000 or more so called standard arrangements. Such a condition is not justified by application requirements of the product, and moreover, such practice increases manufacturing costs and makes impossible the stocking of an item which in the real sense should be a commodity item.

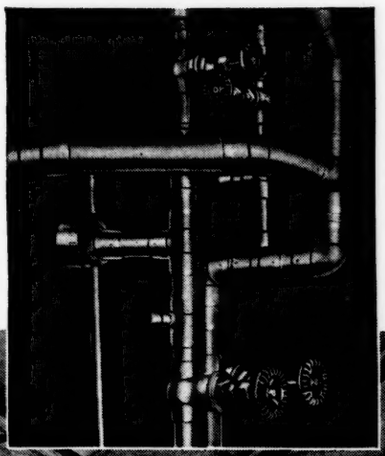
• **PROPOSAL.**—The tentative schedule of sizes that will be considered as standard by the industry are as follows:

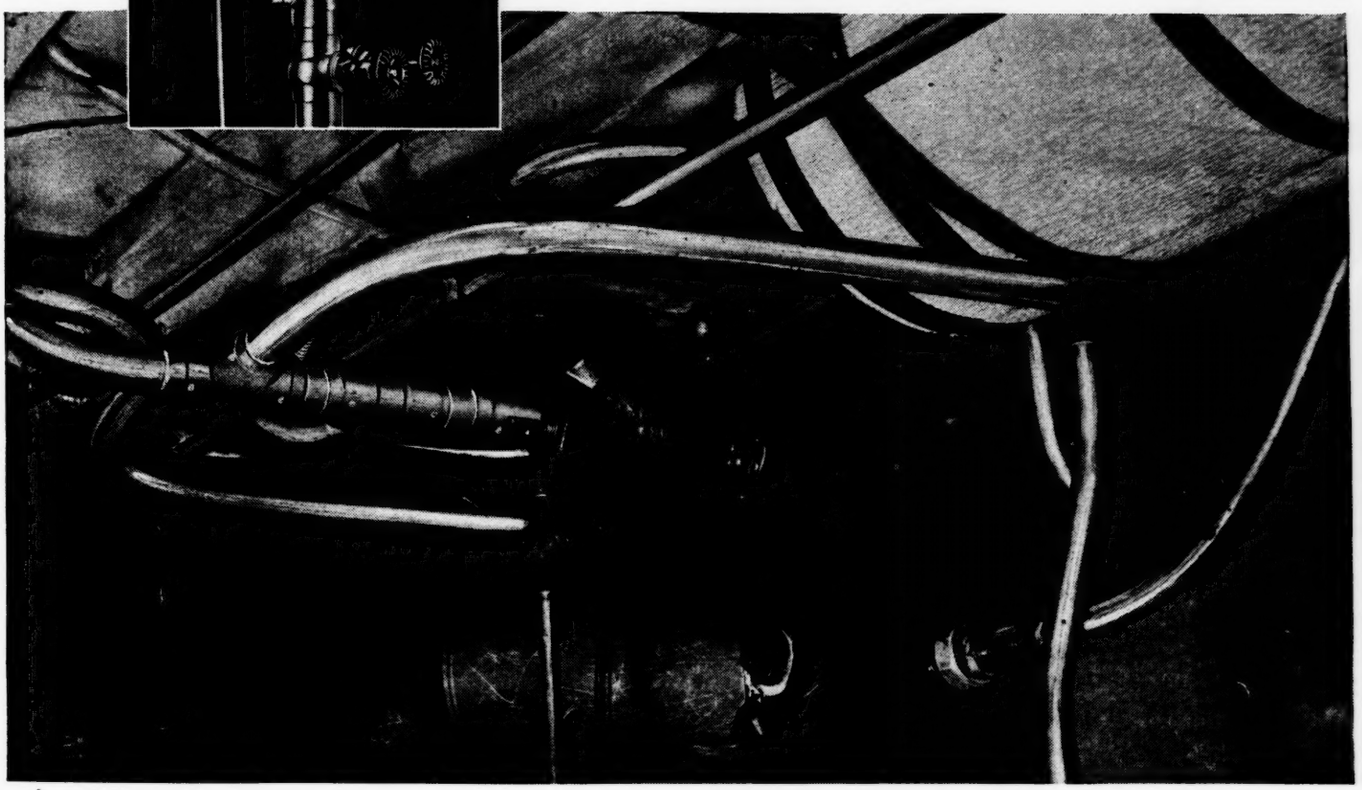
Overall cabinet depths: 6, 8, 10 in., plus or minus ¼ in.

Overall cabinet heights: 20, 24, 32 in. plus or minus ½ in. (tolerance plus or minus ½ in.)

Overall lengths—6 in depth: 20, 24, 28, 32, 36, 40, 44, 48, 56, 64 in.; 8 in. depth: 32, 40, 48, 56, 64 in.; 10 in. depth: 40, 48, 56, 64 in.

2 WAYS TO TURN A CORNER with REVERE COPPER WATER TUBE





EITHER a bend or a fitting will carry Revere Copper Water Tube around a corner, will get a line to the right place by means of the shortest route. Joints are quickly made with either soldered or compression fittings . . . and even the hard temper tube is easy to bend by means of a hand operated tool.

With its smooth gun-barrel interior finish, Revere Copper Water Tube insures an unrestricted flow of water, both in water lines and in heating lines for high velocity forced circulation systems. Because it cannot rust, it is often used for steam return lines. Naturally, it affords maximum protection against leaks and against a flow of rusty water from the taps.

Made for heating, water supply, air conditioning and other services in all types of buildings, this tube is stamped with the Revere name and the type at regular intervals. Look for these identification marks—they insure full wall thickness and the close gauge tolerances so essential for tight sweated joints.

You can specify or install such long-lived Revere materials as Copper Water Tube and Red-Brass Pipe; Sheet Copper for tanks, ducts, pans and trays; Dryseal Copper Refrigeration Tube (dehydrated and sealed); Copper oil burner, heat control and capillary tubes.

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Enclosure Types: (1) Free-standing. (2) Wall type front outlet. (3) Wall type sloping outlet. (4) Partially recessed with back furnished. (5) Partially recessed with back not furnished.

Painting: Prime coat only.

Grille: Manufacturers standard grille only. Standard design has no intake grille, only plain opening.

Tappings: Standard arrangement is bottom supply and bottom return. Thus the up-feed arrangement is standard.

The above sizes have been based on the modular system proposed by the American Standards Assn.

While this standardization program marks a long step forward, the facts are that if a manufacturer made all of the sizes and enclosure types specified above, there would still be 855 combinations.

STEAM LINE

from municipal power plant now supplies heat to three Piqua industries, saves one plant $23,000 per year.

The Piqua (Ohio) municipal power plant early in 1945 persuaded the Orr Felt & Blanket Co. nearby to replace its obsolete and worn steam generating plant and turbo-generator with municipal steam and electric service. A 768-ft line was run to the plant of which all but the final 82 ft was 8-in. steam supply and 3-in. return, the size being in anticipation of additional business from other nearby plants. Figures for a full year's operation show a saving to the industrial plant of $22,800.43 per year.

• **LINES ADDED.**—In the meantime, Meteor Motor Car and Wood Shovel & Tool Co. plants have also been added to the lines, there now being 2006 ft of steam line (of which 82 ft is 6-in. supply, 105 ft 4-in. supply, the remainder 8-in.) serving three plants, plus 2006 ft of 3-in. return lines. Ric-wiL prefabricated Fiberglas-insulated conduit was used for all lines. Several other industrial plants and a laundry are prospective steam purchasers.

• **SAVINGS.**— Prior to 1945, Orr Felt & Blanket had annual steam requirements of over 107 million pounds of which electric generating and auxiliaries took over 42 million pounds, process steam totaled 39 million pounds and heating 26 million pounds. The total cost of operating the plant was $87,000 per year. The municipal plant now furnishes electric energy at 1.35 cents per kw hr and 76 million pounds of steam at about 150 lb gage at an average rate of about 62 cents per 1000 pounds, the total cost being $72,814 per year for a period when the electrical consumption was up 50% due to increased activity. Adjusting for this, the savings per year were nearly $23,000.

In addition, the textile firm was relieved of facing a $100,000 investment for new equipment, instead sold its old boilers and generator, now plans to make use of space formerly used for the plant and coal storage.

Plans and specifications for the installation were drawn up by W. I. Barrows & Associates, consulting engineers, Dayton, Ohio, in cooperation with John P. Gallagher, Piqua's public utilities director. Contractors were the E. W. File Plumbing and Heating Co., Lima, Ohio, and Huffman-Wolfe Co., Columbus, Ohio. Contracts for Ric-wiL materials were negotiated through Crane Co., Lima, Ohio.

METALLIC WALLPAPER

improves heating of domestic rooms and saves fuel, according to British tests.

Experiments in space heating by a young British woman physicist, Miss Marian Griffiths, B.Sc., London, brought out the improvement in space heating resulting from the use of metallic wallpaper.

• **REFLECTOR.**—In a specially constructed model room containing a model radiator and an instrument representing a human figure, Miss Griffiths tested different types of wall covering and building materials, measuring the rate of change of warmth in the room for each material. Among her chief findings was the discovery that by using a metallic wallpaper as a reflector on a plain plaster wall, the time taken to reach a given temperature could be reduced from 60 to 20 minutes.

• **WALL BOARD.**— She also found that a rapid increase in the rate of warming could be obtained by lining the walls with wallboard of a highly resistant material such as fiber, cork or felt. With this method a room held the heat over a long period as well as warming up quickly. For quick heating, the wallboard had to be placed on the surface of the wall, as insulation buried in the body of the wall was found to have little effect on rapidity of warming.

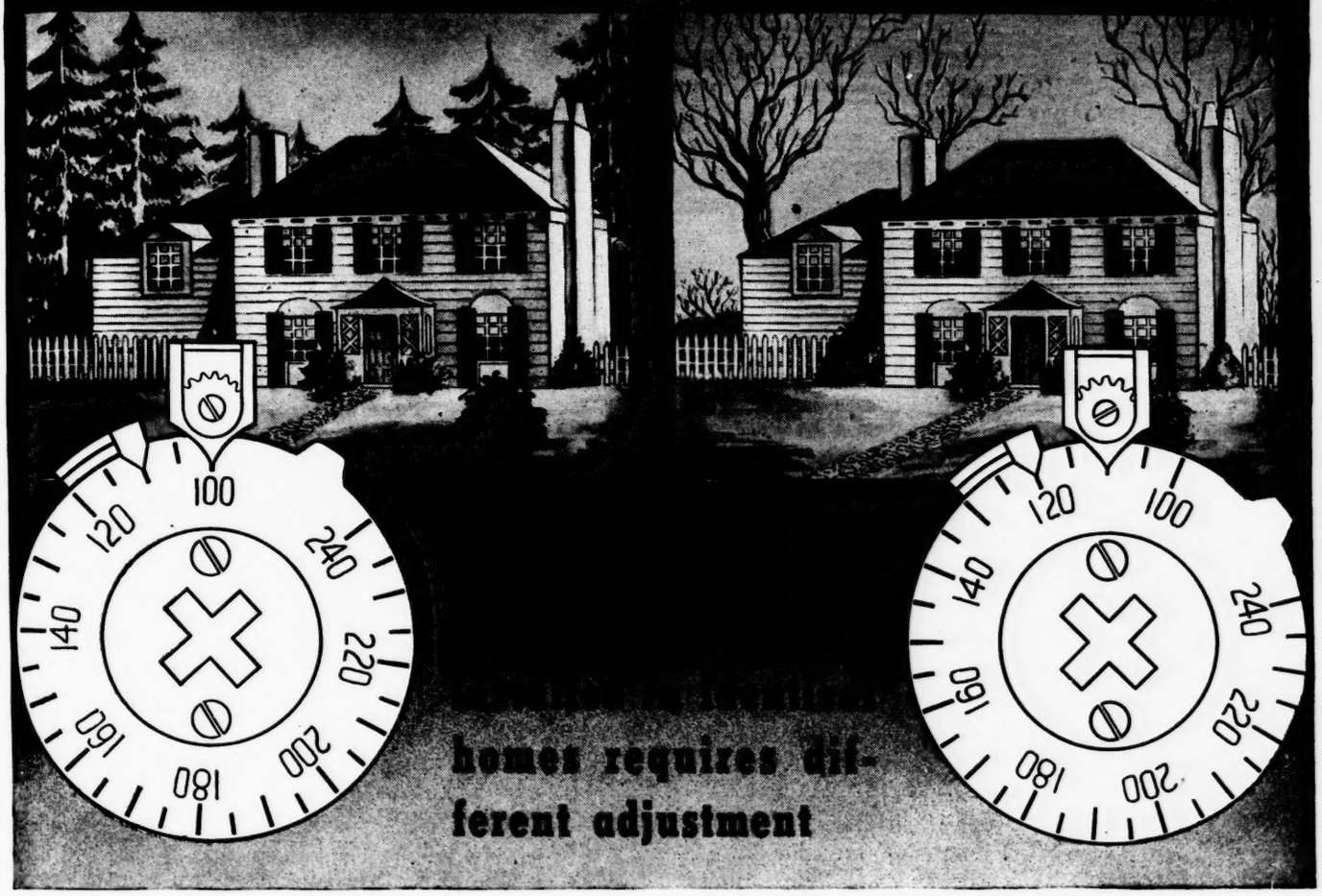
CONCENTRATION STANDARD

for trichloroethylene fumes is set up by American Standards Association.

A new weapon in the fight for healthful industrial atmospheres was made available by the American Standards Association in an American Standard covering the safe permissible concentration of trichloroethylene, a commercial degreasing agent, fumes of which are dangerous to factory personnel.

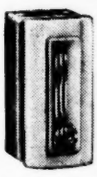
• **COMMITTEE.**—A sectional committee of ASA under the general chairmanship of William P. Yant, Director of Research and Development, Mine Safety Appliances Co., concluded after a study which was initiated in 1943 that concentrations of trichloroethylene exceed-

How W-R Controls Can Make YOUR EQUIPMENT WORK BETTER



External conditions such as exposure, prevailing winds and even the number of people in the house call for different requirements from a heating plant.

As the dials of White-Rodgers automatic temperature controls are marked accurately in degrees Fahrenheit and the controls perform exactly as set anywhere within the range of the control, more and more manufacturers of heating equipment are adopting them as standard.



Upper left: **Series 120 Room Thermostat is modern in design, finished in ivory and chrome to harmonize with any scheme of room decoration. Efficient and reliable.**

Lower left: **Series 1100 combination Limit and Circulator Control for forced flow systems. Provides accurate circulator and positive limit control. Two independently operating controls in a single case.**

Upper right: **Series 3000 Gas Safety Pilot is simple in design and reliable in performance. Operates by difference in expansion of two stainless steel members. Automatically recycles, requires only relighting.**

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WHITE-RODGERS ELECTRIC CO.

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ing 200 parts in one million parts of air were dangerous. A study of the effects of the solvent was sponsored by the American Industrial Hygiene Association and original draft of the standard was prepared by a subcommittee headed by Frank S. Low, of Westvaco Chlorine Products Corp.

• **OTHERS.**—The new standard is the 17th to be developed by voluntary groups of interested organizations and released through the machinery of ASA, in the field of air contamination, by dust, fumes, mists, gases and vapors which are potentially harmful to workers. These include four developed especially as war standards: Those for manganese, metallic arsenic and arsenic trioxide, xylene, and styrene monomer. Others include such common industrial substances as carbon monoxide, hydrogen sulfide, benzene, lead and its compounds, methanol and formaldehyde.

COAL HEATING SERVICE

inaugurated by National Coal Association to hold the line for bituminous against gas and oil.

The first Nation-wide program organized for the purpose of increasing public acceptance of bituminous coal and coke got under way in Chicago under the sponsorship of the National Coal Association, producers' organization for the coal industry. Basic premise of the program is that every community needs 24-hour coal heating service.

• **PROGRAM.**—The coal heating service program originated with an earlier plan developed by Bituminous Coal Institute, a smaller producer group, which included a "Better Home Heating Service" plan under which fuel dealers would set up facilities for servicing their customers on a 24-hour basis.

NCA's plan includes a 4-point program:

(1) Improve standards for retail sale, delivery and service,

(2) Encourage use of better coal burning equipment and controls and provide expert servicing of all equipment,

(3) Improve public opinion of coal and the industry generally through local service and advertising,

(4) Develop additional demand for domestic coal, particularly in the new home market and the rural markets.

• **ADVERTISING.**—NCA plans to use both advertising and public relations in putting the program over. The first action of the organization was to appoint J. Nelson Stuart, general manager of the Coal Heating service Division. Mr. Stuart is working from NCA's Washington headquarters and has been on a speech-making tour of midwest cities explaining the plan to groups of the nation's 50,000 retail coal dealers.

Funds for financing the program will come from the retailers and will be matched by NCA up to 2c a ton sold by retailers. Cooperation of retailers seems assured, but not until they form local groups and go into action. The potential budget can be gaged by a coal production rate on September 1 of 350 million tons, strikes and all.

UNIFORM BUILDING CODE

planned and developed by building officials in effort to dispel existing confusion.

In the current excitement over the country's antiquated system of building codes local building officials often have had to dodge more than their share of brickbats, according to a "Business Week" report. The municipal building official, as a rule, has little to do with writing the law he administers, but if it turns out that the code is holding up new housing or hiking construction costs, he comes in for a slice of the blame.

Partly in self defense, building officials have decided to take a hand in code writing. The annual convention of the Building Officials Conference of America in Memphis approved a double-barreled program for straightening out the muddle.

In many ways, its plan is the most ambitious of all the cures that have been proposed for the building code headache.

• **GOAL: UNIFORMITY.**—The first part of BOCA's scheme calls for drawing up a brand-new uniform code that would serve as a model for all municipalities. This project already has been in the works for two years, and conference officials hope to have it finished by the end of 1946.

The second half provides for establishment of a semi-independent Building Officials Foundation, which would be something new in the building picture. Its job would be to keep the model code up to date and to test new materials and methods of construction to see if they meet requirements.

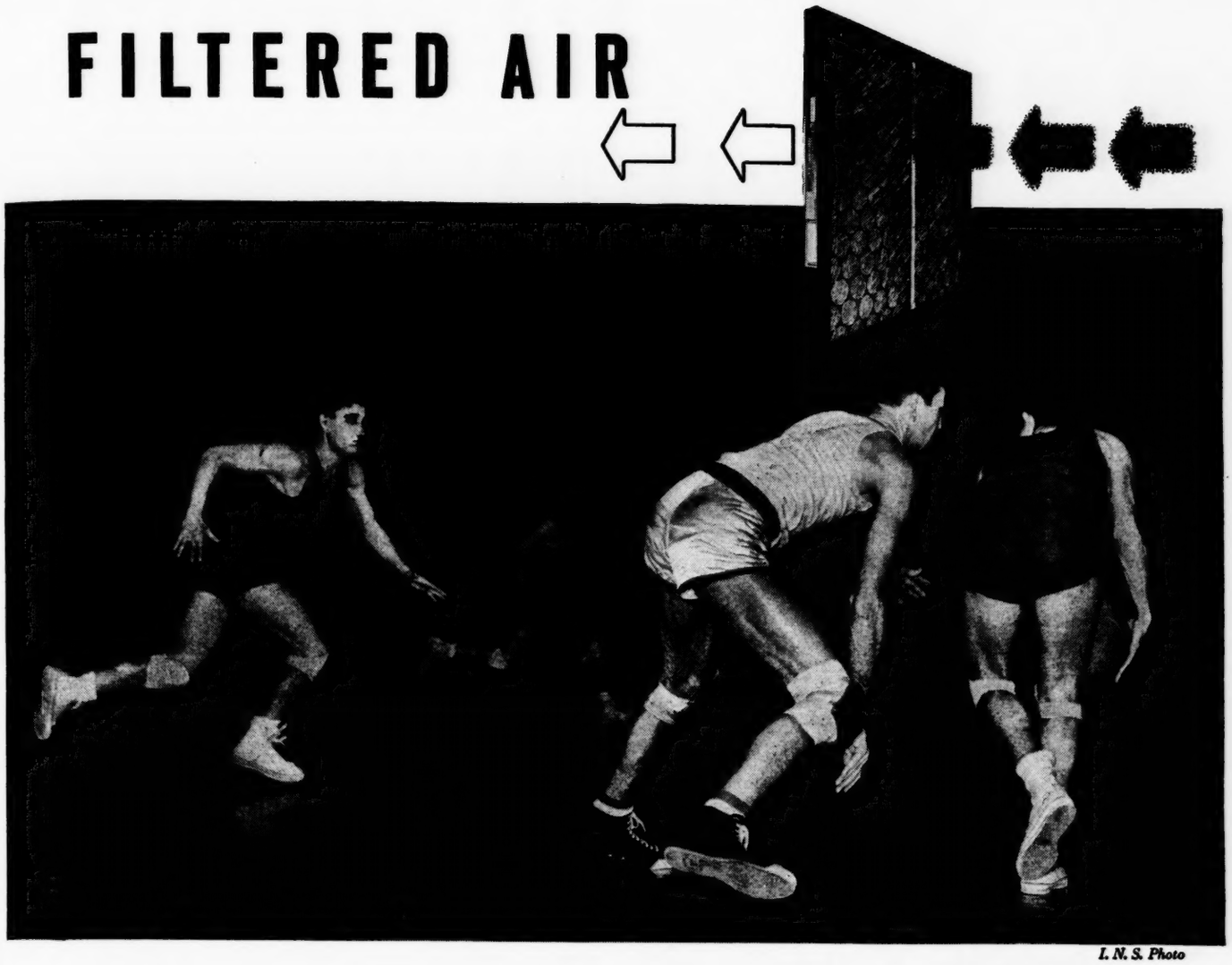
If everything works out according to the blueprint, the foundation will do roughly the same thing for building officials and producers of building materials that Underwriters Laboratories does for insurance companies and makers of items that have to meet fire-resistance standards.

• **PRECAUTION.**—BOCA's new model code will be written in two sections. By this dodge the authors hope to keep it from getting out of date before the municipalities have time to adopt it.

The first section will lay down all the basic standards that construction has to meet. It will be written almost entirely on a performance basis; that is, it will not specify how the structure is to be built but only the qualities (fire resistance, loads, stresses, etc.) that will be expected of it.

• **SUBJECT TO CHANGE.**—The second section will describe all approved methods of meeting the requirements set up in the first part. This will be written on a specification basis, detailing just what methods and

FILTERED AIR



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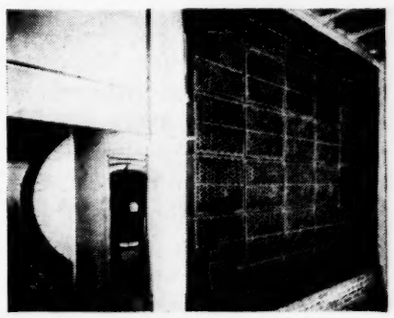
DUST-STOP Air Filters are adaptable all the way from the smallest to the largest commercial and industrial heating, ventilating and air-conditioning systems. They may be installed in custom-built frames or in the complete, ready-to-assemble, DUST-STOP steel frame cells. These cells can be built up into filter banks to handle any *cfm* of air required. Once the filter bank is installed, maintenance is easy and economical. Replacement DUST-STOPS are readily available from authorized suppliers in every community.

Complete information on DUST-STOP Air Filters will be sent on request. Write for 24-page illustrated booklet—"Air Filtration in Central Systems" (A5.2.1). Owens-Corning Fiberglas Corporation, Dept. 912, Toledo 1, Ohio. Branches in principal cities.

In Canada: Fiberglas Canada Ltd., Toronto, Ontario.



A typical DUST-STOP installation used in the Vocational High School, McKeesport, Pennsylvania, providing DUST-STOP filtered air for contestants and spectators in the school's large auditorium.

DUST STOP

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AIR FILTERS

—a FIBERGLAS product

materials will do the job. It will change constantly as new methods are developed and approved. BOCA plans to keep it in loose-leaf form and send out frequent supplements.

To meet the needs of small towns, there also will be a special simplified code, dealing mainly with frame and ordinary masonry construction.

• **DOUBLE FUNCTION.**— BOCA executives are counting on the new Building Officials Foundation to breathe life into the code and keep it abreast of changes in construction methods.

The idea is that whenever a manufacturer has a new material or a contractor a new method, he will bring it to the foundation for testing. If it meets the standards, the foundation will include it among the approved methods in the second part of the code.

The foundation's technical staff also will be ready to backstop any municipal building official who draws a problem that is too tough for him. For example, if a local official has to pass on a complicated plan for barrel-vault construction, he will be able to send it along to the foundation staff and let them wrestle with the mathematics.

• **FUNDS SOUGHT.**— The foundation's first job, however, will be to raise a fund to start operations. It hopes to build up a $600,000 kitty in contributions from contractors and building materials manufacturers. Once it gets going, it will operate as a nonprofit institution, billing contractors or building officials for the costs of each job it does.

REFRIGERATION CODES

revised by Wisconsin, Los Angeles, and New York City to accommodate new refrigerants.

Wisconsin's State Industrial Commission held the first in a series of hearings here Sept. 19 on a proposed new state refrigerating plant code.

• **REVISED.**—Commissioner Harry J. Burczyk explained that the proposed code would revise a 1918 code and bring it up to date. The major change, he said, would regulate the use in refrigeration plants of new gases and refrigerants which have been developed in the last 25 years. It would ban the use of injurious gases or refrigerants in hospitals, theatres, auditoriums, large restaurants and other places where large crowds assemble.

Most refrigerating plants in the Milwaukee area already have high standards of safety which, for the most part, comply with provisions of the proposed code, it was indicated by about 60 plant operators and equipment manufacturers at the hearing.

Several operators who questioned the cost of making changes in installations were told that they would be allowed to continue operating under the old code until it was necessary for them to make new installations.

Other hearings on the proposed code were scheduled to be held in Madison, La Crosse and Green Bay.

• **LOS ANGELES.**—A new Los Angeles refrigeration code covering installation, operation, location and repair of refrigeration systems was completed in June after more than three years of preparation work by city officials in collaboration with members of refrigeration and air conditioning associations and building organizations.

The code sets forth refrigerants and the amounts that may be used in specified types of group occupancy; defines refrigerants permissible for use in connection with air conditioning systems; provides for contractors' registration and the issuance of qualification certificates based on mandatory examinations; and establishes rigid inspection and control over equipment and method of installation.

The new measure is entitled Chapter 9, Article 5, Division C, Parts 40 to 54 of the Los Angeles Municipal Code.

The code does not apply to the use or maintenance of any refrigerating system or equipment installed prior to its effective date, provided the equipment is not unsafe under the new code's definitions.

The city superintendent of building is empowered to order all work stopped on portions of an installation on which violations of the code are in evidence and to order removal of the illegally installed equipment. He is also authorized to order any refrigeration system which has been found to be unsafe to be restored to a condition of safety or dismantled, and to fix a limiting date for such action.

The code stipulates that no person shall act as, or represent or advertise himself as being a refrigeration contractor or mechanic unless he holds a valid and unrevoked certificate issued by the Board of Building and Safety. Also stipulated under the code are classes of refrigerants with regard to relative safety, location of equipment in buildings, maximum allowable amounts and pressures, etc.

• **NEW YORK.**— Regulations governing the use of "Freon" refrigerants in New York City have been altered by the New York Fire Department to permit the use of "Freon-21," "Freon-22," and "Freon 113." Heretofore only "F-11," "F-12," and "F-114" were permitted.

These changes became effective recently with the issuance of Circular No. 2 by Frank J. Quayle, New York fire commissioner.

Numerous restrictions regarding applications of these refrigerants still apply, however. Although the circular states the six refrigerants mentioned are "non-flammable and non-irritant," the Fire Department rules that "when used in a room or rooms in which there is an open flame or apparatus to produce an open flame, then the provisions of said article covering irritant refrigerants shall apply."

The ruling also requires that "systems containing more than six (6) lbs. of F-21 or F-113 be confined to separate machinery rooms in accordance with Section C19-99a, Administrative Code."

WEATHER
ear with dimin-
hing costs.

TINNERMAN NEWS EXTRA

76TH YEAR OF
TINNERMAN PROGRESS

CLEVELAND, NOVEMBER, 1946

76TH YEAR OF
TINNERMAN PROGRESS

BUYERS GET HOT TIP

MASS PRODUCTION OF NEW SERIES SPEED NUTS RESPONSIBLE FOR LOWEST PRICES IN HISTORY

Buyers Determine Savings by Checking Present Purchases of Threaded Nuts and Lock Washers

It is a simple matter to determine the savings made in the assembly of any product by converting to C7000 Series Speed Nuts.

Buyers are simply taking count of the number of threaded nuts and lock washers used daily on ... chine screws and sheet ... screws. For example, one ... facturer using 18,000 ... nuts and lock washers ... found that the total consu... exceeded 5 million a ye... annual net saving by co... to spring-tension Speed ... into a substantial figure. ... version was made immedia...

In addition to saving on ... per thousand, converting t... Speed Nuts also gave the ... advantage of time savi... Speed Nuts are applied fa... reduced weight, it lowers ... portation charges and it e... the old problem of ... loosening.

Then too, in many as... space is limited. A Speed ... be applied where the spac... small to apply threaded p... lock washers without tedi... wasting delays.

Even if the C7000 Serie... cost more than threaded n... lock washers, they would ... down the total not assemb... But with their lower pri... savings are still greater o... product using machine scre... sheet metal screws in any ... ten most popular sizes.

The C7000 Series Speed ... are accurately heat treate... given a rust resisting finis... live action spring steel lo... screw with a firm grip. Lo... is fully prevented because ... spring steel nut absorbs th... tion which causes loosen... conventional threaded nuts.

Billions of Speed Nuts ... proved their work on hundr... mass production products for ... than a decade. The time to co... is now. Every day's delay is ... in savings otherwise effected.

NEW SPEED NUTS HAVE RUST-RESISTING FINISH

The corroding and rusting of ordinary threaded nuts presents a serious problem in connection with servicing and replacing ... nuts must be ... Having no ...

Shrewd, alert, cost-conscious John Buyer, speaking today for American Industry, admitted wide affect of latest Tinnerman Announcement. He predicted that, "The new C7000 Series Speed Nuts, costing less than threaded nuts plus lock washers, will save hundreds of thousands of dollars, as well as give impetus to better and faster assembly of mass production products". From Cleveland comes word that large stocks are on hand for immediate delivery. Prices and samples of the new Speed Nuts can be had for the asking.

Speed Nuts may be used on porcelain enamel, glass or plastic assemblies *without danger of breakage.* They provide the spring tension necessary for tight assembly, yet are sufficiently resilient to prevent damage due to expansion and ... vibration or shock.

The *wide bearing surface* of the Speed Nut spreads the fastening load over a much greater area than does an ordinary threaded nut. Therefore, the use of separate spanner washers is unnecessary. Here again there's a saving in cost and assembly time.

Speed Nuts hold ...

Speed Nuts are *self-locking,* for their unique spring action provides a positive lock that prevents vibration loosening. Thus, the use of separate lock washers is completely eliminated. You save the cost of the washers and the time ... to handle and install ...

SPEED NUTS ELIMINATE LOCK WASHERS

With the use of C7000 Speed Nuts, the lock washer is necessary and obsolete. The purpose of the lock washer is to supply a spring-tension between the threaded nut and the part. With the spring-tension incorporated in the Speed Nut, only one part is necessary instead of two. Only one part to purchase, one part to handle. In addition, this the Speed Nut affords spring-tension that can be cured with a lock washer tight over the nut. And Speed Nuts never need chiseled or sawed off for replacement. There's no expensive delay on the assembly line because of lost damage when Speed Nuts are used. For Speed Nuts are resiliency prevents ... ing parts to such a degree ... porcelain enamel, glass or plastic might crack or chip.

Speed Nuts are also insurance against damage in transit. Your products are subject to severe vibration and shock while being handled and shipped. Packed, Speed Nuts provide a resiliency that cushions and protects porcelain enamel and glass assemblies against damage.

Eliminating a lock washer not only cuts the number of parts in half but it also cuts the work in half. The Speed Nut also has a wider bearing surface. That feature also prevents distortion of the panel or part to which the nut holds.

When you cut down the amount of buying you reduce stocking problems and handling problems. You save on transportation charges and you have a nut that does a more satisfactory holding job.

Many ... themselves ... tion, eliminating expensive welding, riveting or clinching operations, as well as the costly equipment and space required for such operations. Moreover, installing these Speed Nuts *does not require skilled labor.*

Since Speed Nut prongs can be formed, incorporated in most any shape or hundreds of Speed Nuts have been designed to combine several parts into one. Thus, a single Speed Nut often replaces two, three or more parts and does the same job easier and faster.

The Speed Nut principle of fastening lends itself to a flexibility of design possessed by no other fastener. Speed Nuts can be made to meet the requirements of specific applications, to simplify and improve product design, and do a better and faster assembly job.

... replac... washers, as ... hundreds of special fasteners to meet the requirements of out-of-the-ordinary applications.

In addition, our Engineering Department is at your service at all times to help solve your fastening problems, and would welcome the opportunity to analyze your fastening requirements.

A changeover to the "Fastest Thing in Fastenings" will very definitely improve your product, speed up production and reduce your total net assembly costs.

Speed Nuts provide a *double* lock on bolt or screw to prevent vibration loosening . . . a thread lock and a spring lock. Their *live* spring action *absorbs* vibration, instead of merely resisting it, insuring a tight attachment for the life of the product.

... are attached ... Nuts always ... *their spring tension locking power.* And Speed Nuts never have to be chiseled or sawed off, requiring a new nut for replacement.

There's no expensive delay on the assembly line because of product damage, when Speed Nuts are used. For Speed Nut spring tension resiliency prevents tightening parts to such a degree that porcelain enamel, glass or plastic might crack or chip.

Speed Nuts are also insurance against damage in transit. Your products are subject to severe vibration and shock while being packed, handled and shipped. Speed Nuts provide a resiliency that cushions and protects porcelain enamel and glass assemblies against damage.

... size retaining ... blind assembly ... sary. "Float" to compensate for misalignment of clearance holes.

When ordinary threaded nuts are permanently attached to parts for blind assembly, and the parts painted, the threads become clogged with paint. This makes it necessary to delay final assembly until the threads can be retapped. Having no threads, Speed Nuts *do not clog.*

The corroding and rusting of ordinary threaded nuts presents a serious problem in connection with servicing and replacing parts, because the nuts must be chiseled or sawed off. Having no threads, Speed Nuts *will not "freeze"* to bolts or screws, and are easily removed.

Greater Strength is Result of 20 Years of Engineering Experience

Back of the C7000 Series is all the experience of the Tinnerman factories and their extensive engineering development department. For more than 20 years the Tinnerman organization has devoted itself to studying and solving assembly problems. No other organization has a comparable record of engineering development in this field.

Speed Nuts

Degree-Days for September, 1946

HEATING AND VENTILATING'S 20TH YEAR OF PUBLICATION OF MONTHLY DEGREE-DAY DATA

CITY	SEPTEMBER			CUMULATIVE, SEPTEMBER 1 TO SEPTEMBER 30			HEATING SEASON[1]
	1946	1945	NORMAL	1945-46	1944-45	NORMAL	NORMAL
Abilene, Texas	5	37	0	5	37	0	2061
Albany, New York	91	111	72	91	111	72	6580
Albuquerque, New Mexico	12	53	0	12	53	0	4298
Alpena, Michigan	216	252	222	216	252	222	8299*
Anaconda, Montana	380	398	335	380	398	335	8357**
Asheville, North Carolina	35	18	0	35	18	0	4232
Atlanta, Georgia	14	1	0	14	1	0	2890
Atlantic City, New Jersey	19	19	0	19	19	0	5176
Augusta, Georgia	0	0	0	0	0	0	2161
Baker, Oregon	295	328	258	295	328	258	7163
Baltimore, Maryland	11	19	0	11	19	0	4533
Billings, Montana	211	299	189	211	299	189	7119
Binghamton, New York	(a)	114	108	(a)	114	108	6808
Birmingham, Alabama	15	1	0	15	1	0	2352
Bismarck, North Dakota	263	330	222	263	330	222	9192
Block Island, Rhode Island	48	46	0	48	46	0	5788
Boise, Idaho	167	227	102	167	227	102	5552
Boston, Massachusetts	57	71	48	57	71	48	6045
Bozeman, Montana	309	386	336	309	386	336	8521**
Buffalo, New York	109	125	75	109	125	75	6822
Burlington, Vermont	129	171	144	129	171	144	7514
Butte, Montana	433	446	344	433	446	344	8272
Cairo, Illinois	10	16	0	10	16	0	3909
Canton, New York	167	210	189	167	210	189	8020
Charles City, Iowa	170	221	93	170	221	93	7588
Charleston, South Carolina	0	0	0	0	0	0	1769
Charlotte, North Carolina	6	3	0	6	3	0	3120
Chattanooga, Tennessee	8	1	0	8	1	0	3118
Cheyenne, Wyoming	257	359	240	257	359	240	7466
Chicago, Illinois	56	103	76	56	103	76	6077
Cincinnati, Ohio	14	24	0	14	24	0	4684
Cleveland, Ohio	62	75	27	62	75	27	6155
Columbia, Missouri	70	30	0	70	30	0	4922
Columbia, South Carolina	1	0	0	1	0	0	2364
Columbus, Ohio	35	31	0	35	31	0	5398
Concord, New Hampshire	142	164	168	142	164	168	7353
Concordia, Kansas	75	111	0	75	111	0	5315
Dallas, Texas	0	18	0	0	18	0	2256
Davenport, Iowa	73	123	0	73	123	0	6289
Dayton, Ohio	(a)	47	0	(a)	47	0	5264
Denver, Colorado	99	219	72	99	219	72	5874
Des Moines, Iowa	103	124	0	103	124	0	6384
Detroit, Michigan	85	109	42	85	109	42	6490
Devils Lake, North Dakota	315	390	276	315	390	276	9970
Dodge City, Kansas	64	118	0	64	118	0	5035
Dubuque, Iowa	114	161	36	114	161	36	6790
Duluth, Minnesota	304	344	270	304	344	270	9483
Eastport, Maine	199	239	276	199	239	276	8520**
Elkins, West Virginia	124	62	63	124	62	63	5697
El Paso, Texas	4	28	0	4	28	0	2428
Ely, Nevada	268	311	(a)	268	311	(a)	(a)
Erie, Pennsylvania	73	83	36	73	83	36	6273
Escanaba, Michigan	272	263	243	272	263	243	8771*
Evansville, Indiana	34	25	0	34	25	0	4244
Fort Smith, Arkansas	6	8	0	6	8	0	3147
Fort Wayne, Indiana	87	102	0	87	102	0	5925
Fort Worth, Texas	0	22	0	0	22	0	2148
Fresno, California	0	4	0	0	4	0	2334
Galveston, Texas	0	0	0	0	0	0	1016
Grand Junction, Colorado	62	91	0	62	91	0	5548
Grand Rapids, Michigan	94	150	57	94	150	57	6535
Green Bay, Wisconsin	185	222	132	185	222	132	7825
Greensboro, North Carolina	20	11	0	20	11	0	3529
Greenville, South Carolina	10	4	0	10	4	0	3380
Harrisburg, Pennsylvania	47	57	0	47	57	0	5375
Hartford, Connecticut	52	77	48	52	77	48	6036
Hatteras, North Carolina	0	0	0	0	0	0	2571
Havre, Montana	279	353	270	279	353	270	8700
Helena, Montana	313	379	251	313	379	251	7898
Houston, Texas	0	0	0	0	0	0	1157
Huron, South Dakota	193	240	123	193	240	123	8004
Indianapolis, Indiana	39	47	0	39	47	0	5298
Jackson, Miss.	0	0	(a)	0	0	(a)	(a)
Kansas City, Missouri	37	62	0	37	62	0	4956
Kewanee, Illinois	48	69	78	48	69	78	6139
Knoxville, Tennessee	12	6	0	12	6	0	3670
La Crosse, Wisconsin	200	238	96	200	238	96	7322
Lander, Wyoming	266	365	276	266	365	276	7947

[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

Figures in this table, with nine exceptions, based on local weather bureau reports. Exceptions are Utica, Lewiston, Kewanee, Sioux City, and Jackson, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y.; Norman E. Ross, Bursar, Bates College, Lewiston, Me.; J. M. Hartman, Engineering Department, Kewanee Boiler Corp., Kewanee, Ill.; Alfred R. Wagstaff, Engineer, Sioux City Foundry and Boiler Co., Sioux City, Iowa, and H. M. Ludlow, Box 1368, Jackson, Miss., respectively; Anaconda, Bozeman, Butte and Livingston, Mont., through the courtesy of the Montana Power Company.

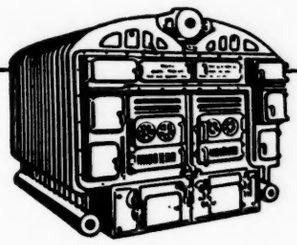
[Table concluded on page 108]

I Was "Educated" On Cast Iron Years Ago!

SCHOOL EXECUTIVES are in a uniquely favorable position to compare fuel and maintenance costs of different types and models of boilers. Almost invariably, their experience produces a strong preference for cast iron. There are sound reasons . . .

Cast-iron boilers last longer. Their cost per year of service is lower because of their unusual resistance to rust and corrosion. They are sectional . . . easy to install and replace. Modern cast-iron boilers are highly efficient. They are readily adaptable to all fuels and fuel-burning methods.

Long-term comparative studies of overall operating costs have definitely established recognition of the superiority of H. B. Smith Cast-Iron Boilers. This is but typical of a recognition which extends into the commercial, industrial, institutional and residential fields. Write today for your free catalog.



H.B. Smith

CAST-IRON BOILERS

THE H. B. SMITH CO., INC., WESTFIELD, MASS. Offices and Representatives in Principal Cities

Degree-Days for September, 1946 (Concluded)

HEATING AND VENTILATING'S 20TH YEAR OF PUBLICATION OF MONTHLY DEGREE-DAY DATA

CITY	SEPTEMBER			CUMULATIVE, SEPTEMBER 1 TO SEPTEMBER 30			HEATING SEASON[1]
	1946	1945	NORMAL	1945-46	1944-45	NORMAL	NORMAL
Lansing, Michigan	128	180	114	128	180	114	7048
Lewiston, Maine	160	195	165	160	195	165	7707
Lincoln, Nebraska	67	112	0	67	112	0	5999
Little Rock, Arkansas	5	13	0	5	13	0	2811
Livingston, Montana	302	361	227	302	361	227	7205
Los Angeles, California	0	2	0	0	2	0	1504
Louisville, Kentucky	19	12	0	19	12	0	4180
Lynchburg, Virginia	32	15	0	32	15	0	3980
Macon, Georgia	7	0	0	7	0	0	2201
Madison, Wisconsin	132	187	87	132	187	87	7429
Marquette, Michigan	261	281	225	261	281	225	8693*
Memphis, Tennessee	5	11	0	5	11	0	2950
Meridian, Mississippi	2	0	0	2	0	0	2160
Milwaukee, Wisconsin	140	170	84	140	170	84	7245
Minneapolis, Minnesota	195	227	93	195	227	93	7850
Modena, Utah	(a)	178	156	(a)	178	156	6562
Montgomery, Alabama	2	0	0	2	0	0	1884
Nantucket, Massachusetts	75	56	63	75	56	63	5957
Nashville, Tennessee	7	7	0	7	7	0	3507
New Haven, Connecticut	46	64	39	46	64	39	5895
New Orleans, Louisiana	0	0	0	0	0	0	1024
New York, New York	19	33	0	19	33	0	5347
Nome, Alaska	Degree-Days for June, 1946 (not previously published) are 633. Total for season (Sept. 1 to June 30, 1946) is 13921.						
Norfolk, Virginia	1	0	0	1	0	0	3350
North Head, Washington	234	288	255	234	288	255	5452**
North Platte, Nebraska	103	197	42	103	197	42	6366
Oakland, California	74	75	90	74	75	90	3143**
Oklahoma City, Oklahoma	16	45	0	16	45	0	3613
Omaha, Nebraska	84	116	0	84	116	0	6131
Oswego, New York	112	134	114	112	134	114	7088
Parkersburg, West Virginia	21	34	0	21	34	0	4775
Peoria, Illinois	76	102	3	76	102	3	6109
Philadelphia, Pennsylvania	12	31	0	12	31	0	4855
Phoenix, Arizona	0	0	0	0	0	0	1405
Pittsburgh, Pennsylvania	32	62	0	32	62	0	5235
Pocatello, Idaho	215	307	156	215	307	156	6655
Portland, Maine	146	178	162	146	178	162	7218
Portland, Oregon	116	111	105	116	111	105	4469
Providence, Rhode Island	60	50	63	60	50	63	6015
Pueblo, Colorado	83	176	6	83	176	6	5514
Raleigh, North Carolina	5	0	0	5	0	0	3234
Rapid City, South Dakota	212	285	144	212	285	144	7118
Reading, Pennsylvania	29	44	0	29	44	0	5389
Red Bluff, California	1	5	(a)	1	5	(a)	(a)
Reno, Nevada	170	195	144	170	195	144	5892
Richmond, Virginia	11	3	0	11	3	0	3695
Rochester, New York	138	110	72	138	110	72	6732
Roseburg, Oregon	118	106	111	118	106	111	4428
Roswell, New Mexico	21	58	0	21	58	0	3484
Sacramento, California	2	13	0	2	13	0	2653
St. Joseph, Missouri	44	82	0	44	82	0	5161
St. Louis, Missouri	24	47	0	24	47	0	4585
Salt Lake City, Utah	137	211	18	137	211	18	5555
San Antonio, Texas	0	5	0	0	5	0	1202
San Diego, California	0	1	0	0	1	0	1645
Sandusky, Ohio	44	61	0	44	61	0	6208
San Francisco, California	117	112	114	117	112	114	3264**
Sault Ste. Marie, Michigan	286	354	276	286	354	276	9285**
Savannah, Georgia	0	0	0	0	0	0	1490
Scranton, Pennsylvania	68	83	60	68	83	60	6129
Seattle, Washington	150	171	186	150	171	186	4934**
Sheridan, Wyoming	222	312	264	222	312	264	8008
Shreveport, Louisiana	1	0	0	1	0	0	1938
Sioux City, Iowa	128	192	33	128	192	33	6898
Spokane, Washington	208	266	192	208	266	192	6355
Springfield, Illinois	83	66	0	83	66	0	5373
Springfield, Missouri	41	55	0	41	55	0	4428
Syracuse, New York	123	134	96	123	134	96	6893
Tacoma, Washington	192	237	207	192	237	207	5181**
Terre Haute, Indiana	39	44	0	39	44	0	4872
Toledo, Ohio	79	92	9	79	92	9	6077
Topeka, Kansas	49	71	0	49	71	0	4969
Trenton, New Jersey	24	44	0	24	44	0	4933
Utica, New York	115	131	182	115	131	182	6796
Valentine, Nebraska	156	251	93	156	251	93	7039
Walla Walla, Washington	103	136	30	103	136	30	4808
Washington, D. C.	11	16	0	11	16	0	4626
Wichita, Kansas	36	65	0	36	65	0	4673
Williston, North Dakota	292	404	270	292	404	270	9323
Winnemucca, Nevada	173	243	192	173	243	192	6427**
Yakima, Washington	168	136	120	168	136	120	5599

(a) Data not available.

*Includes August.
**Includes July and August.

[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

Radiant Heating? On-the-job bends made without tools...with *Copper Tube* *

Radiant heating installation of Copper Tube in San Leandro (Calif.) sterilizer factory. Installation by Robert Bruen & Son.

No need for special bending tools when making radiant heating installations of Chase Copper Tube. Flexible and small in diameter, it's easily bent by hand —or shaped, if preferred, around a simple wooden form.

Where engineering considerations make *floor* installations desirable, there's no need for accurate leveling of Chase Copper Tube.

In *ceiling* installations, the light weight of copper tube makes handling and mounting easy.

In both cases, the long lengths of copper tube coils reduce the number of joints to a minimum. Where joints *are* needed, they are quickly made with solder-joint fittings.

With its many advantages, Chase Copper Tube is in heavy demand. We may not, at all times, be able to supply your requirements. But we *can* furnish you with literature you will find helpful in planning radiant heating installations.

Simply write Dept. HV-116.

7 Reasons
WHY CHASE COPPER TUBE FOR RADIANT HEATING

* 1. EASY TO BEND
2. LIGHT IN WEIGHT
3. SOLDERED FITTINGS
4. SMALL DIAMETERS
5. LONG LENGTHS
6. LOW COST
7. LONG LIFE

Chase
BRASS & COPPER CO.
INCORPORATED

Waterbury 91, Connecticut
SUBSIDIARY OF KENNECOTT COPPER CORPORATION

This is the Chase Network—handiest way to buy brass

ALBANY† ATLANTA† BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DETROIT HOUSTON† INDIANAPOLIS JACKSONVILLE† KANSAS CITY, MO. LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER† SAN FRANCISCO SEATTLE ST. LOUIS WASHINGTON† (†Indicates Sales Office Only)

Abstracts AND Reviews

OIL BURNERS

For the oil burner service man or for any one who desires to acquire a working background in installing and servicing oil burners, Audels Oil Burner Guide is very informative. The text is presented as a series of questions and answers arranged in 31 chapters. It contains a large number of illustrations which are easily followed.

While material has been written on the oil burner, it has generally been slanted to the man who has a technical education. This is intended for the serviceman. It describes the equipment available, how to install the units, and how to correct troublesome conditions. It contains a valuable chapter on Electrical Hook Ups.

Audels Oil Burner Guide, by Frank D. Graham. Cloth bound, 4¾ x 6½ in., 364 pages. Published by Theo. Audel & Co. Price, $1.

EQUIPMENT STANDARDS

The 1946 edition of Equipment Standards has just been released by the Air Conditioning and Refrigerating Machinery Association. The new edition is grouped into five parts—room air conditioners and self-contained air conditioners; compressors and condensing units; condensers and receivers; water and brine coolers; and miscellaneous standards. This edition is a revision of the standards published in 1941. These standards are widely used within the industry.

Equipment Standards—1946 Edition. Flexible paper binding, spiral bound, 9¼ x 11¼ in., 100 pages. Published by Air Conditioning and Refrigerating Machinery Association. Price, $2.

AIR DISINFECTION

The use of radiant energy for the disinfection of air is but one of the interesting subjects covered by Dr. Matthew Luckiesh in his book, Applications of Germicidal Erythemal and Infrared Energy. While there is much material which while interesting is out of the domain of the heating and ventilating engineer, the following chapters may prove of value: Germicidal Energy; Disinfecting Controlled Air; Infected Communal Air; Ultraviolet Energy and Plant Life.

At the present time there is considerable interest in sterilization through the use of ultraviolet light. Therefore, the material presented by Dr. Luckiesh should prove of value to the engineer concerned with air sanitation.

Applications of Germicidal Erythemal and Infrared Energy, by Matthew Luckiesh. Cloth bound, 5½ x 8 in., 463 pages. Published by D. Van Nostrand Co., Inc. Price, $5.50.

TRANE MANUAL

One of the standard texts in the air conditioning field is the Trane Air Conditioning Manual, now widely used in colleges and universities. A new or seventh edition has just been published. Because of the problems at the end of each chapter, and the answers in the back of the book, the volume is of value for self-study.

Consisting of eight chapters, the subjects covered are heat, comfort, heat gains, properties of air and the psychrometric chart, calculations for the conditioned air supply, refrigeration for air conditioning, and duct and fans. There are 70 pages of reference tables in simplified form to avoid the use of time-consuming mathematical formulas.

The section on the properties of air has descriptions of how the necessary calculations are made.

Trane Air Conditioning Manual. Cloth bound, 8 x 11 in., 376 pages. Published by The Trane Co. Price, $5.

FUELS AND FUEL BURNERS

For those interested in obtaining an overall picture of fuels and the method of burning these fuels, here is a book that is recommended.

After introductory material on the industry as a whole and the formation of fuels, Mr. Steiner discusses combustion, coal fuel, firing by hand and firing by automatic stokers. The section on fuel oils describes oil burners, oil burner installation and operation. Two chapters are devoted to gas fuels and gas burners. He includes a chapter on wood fuel written by an engineer of the U. S. Forest Service.

Of general interest is the material on fuel-burner controls, chimneys and draft, heating system control, and fans and motors.

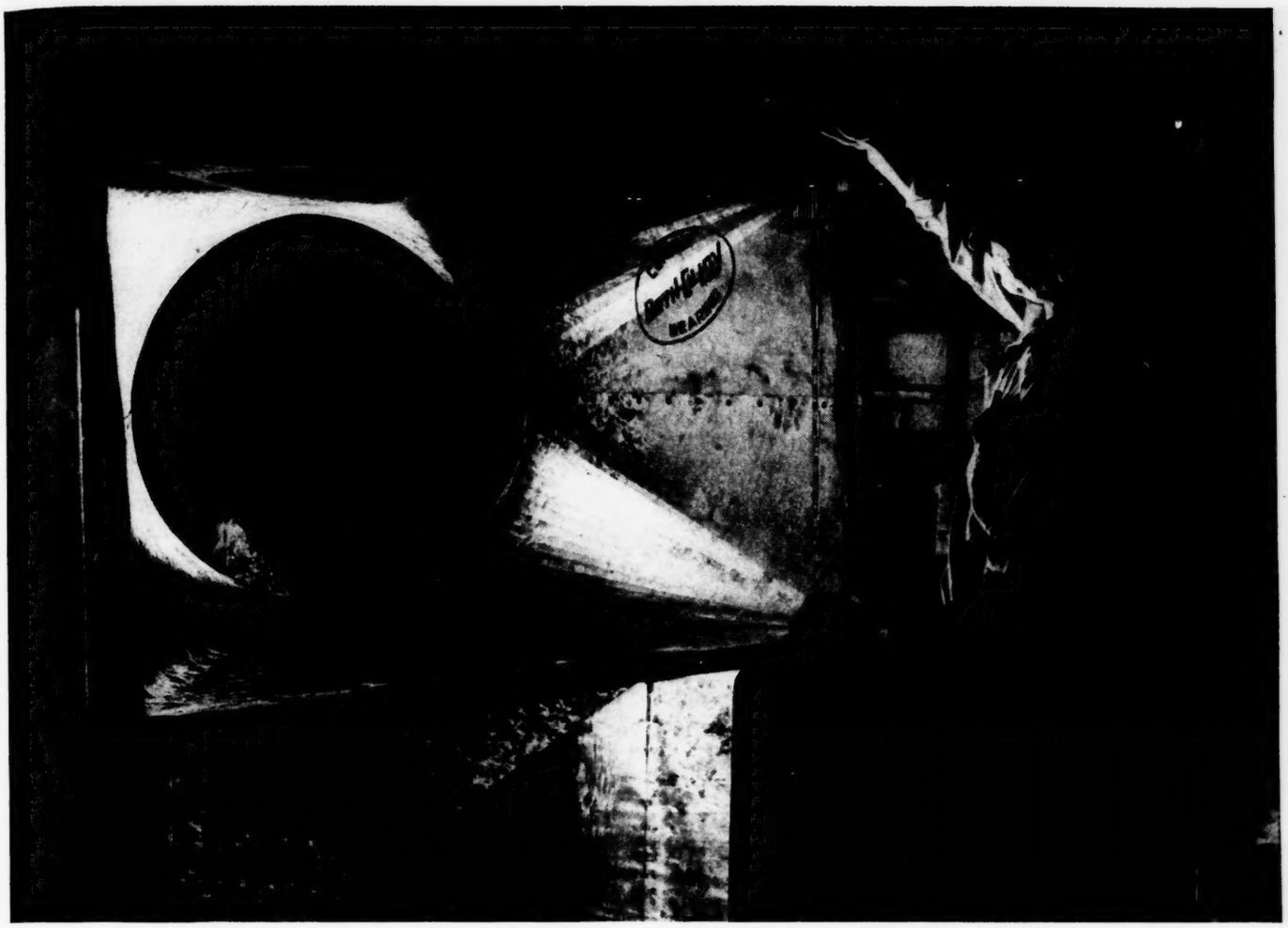
The three chapters on fuel oil and oil burners are condensed from two other books by the author.

This volume is intended for fuel and fuel-burner dealers and salesmen and also installation men.

Fuels and Fuel Burners, by Kalman Steiner. Cloth bound, 5 x 8 in., 394 pages. Published by McGraw-Hill Book Co. Price, $4.50.

• • •

THE REFRIGERATION INDUSTRY.—One of a series of monographs of American Industries designed to help one in the choice of a career. The monograph on the Refrigeration Industry is by David C. Choate, Assistant Manager, Refrigeration Engineering Department, The Crosley Corp., Cincinnati, Ohio. Paper bound, 32 pages, price $1 a copy. Published by Bellman Publishing Co.



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ELECTRIC COOKING—A 20-page standard-size paperbound publication entitled "Commercial Electric Cooking and Baking Manual," and prepared by the Heating and Motor Applications Committee, Commercial Sales Section, Commercial Division of Edison Electric Institute. Defines the commercial cooking load, states how the load can be developed, gives basic engineering and sales data for utility representatives, and includes case history and load data on both cooking and baking. Available from the Institute, 420 Lexington Ave., New York 17, N. Y. Price, 75 cents to members, $1.85 to non-members.

SOURCES OF INFORMATION—A division of the U. S. Department of Commerce has compiled a set of mimeographed sheets that gives a list of all government publications that may be of value as basic information sources for the plumbing, heating and associated industries. It includes a list of trade associations, directories and publications. For copies of Basic Information Sources, Plumbing, Heating and Associated Industries, write to Inquiry Reference Service, U. S. Department of Commerce, Washington 25, D. C.

RADIANT HEAT.—Under the title of Radiant Heating with National Pipe—Bulletin No. 19, the National Tube Co., Pittsburgh, Pa., has issued a 48-page illustrated book of value to the designer of radiant heating systems. It has chapters on estimating heat losses from homes, estimating radiant heating coil requirements both for floor panels and for ceiling panels. Included is an article from HEATING AND VENTILATING on heat losses through floors of basementless buildings. It has data on coil patterns, methods of floor and ceiling installations, and heat transmission tables.

POT TYPE BURNERS.—Commercial Standard CS104-46 covers warm air furnaces equipped with vaporizing pot type oil burners and arranged with either gravity or forced air circulation. The standards cover furnace design and construction, performance, and a test code for gravity furnaces. This is the second edition of these standards which supersede CS(E)104-43. Copies at 10 cents each may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

CATALYTIC CRACKING PROCESS—In "Fluid Progress," there is presented a description of the fluid catalytic cracking of oil refining as improved during the war years to its present state. Included in the 16-page booklet is a diagrammatic illustration in color to show the process of refining. — M. W. Kellogg Co., 225 Broadway, New York 7, N. Y.

FUEL DELIVERY GUIDE.—A 35-page pocket size booklet by K. C. Richmond, editor, Coal-Heat, written for the retail coal yard and delivery man. It covers delivery and coal handling methods, truck operation, sales opportunities, heat regulators, stoker summer service. Price, 20 cents—less in quantities. Coal-Heat, 20 W. Jackson Blvd., Chicago 4, Ill.

NEW CATALOGS

Radiant Heating

A 48-page bulletin No. 19, deals with the subject of radiant heating specifically as it requires the use of steel pipe. Beginning with a general discussion of the nature of radiator heat and the factors affecting human comfort, the bulletin reviews some temperature studies in radiant heated rooms of various types. Design procedure covered by the booklet includes estimating heat losses from houses, estimating radiant heating coil requirements, friction loss curves, formulas, etc. There are discussions of mean radiant temperature, operative temperature, heat losses through floors of basementless buildings, and the claims made for radiant heating. Methods of installation and typical coil patterns are presented and design data for various wall and ceiling structures are included. — *National Tube Company, Frick Building, Pittsburgh, Pa.* 131

Centrifugal Blowers

Bulletin 120-B-13, covering centrifugal blowers and exhausters, 8 pages in two colors, emphasizes the adaptability of Roots-Connersville Blowers to a variety of uses. It is stated that these units are equally effective as boosters or as exhausters. Units are offered in both single and multi-stage types with capacities up to 100,000 rpm.—*Roots-Connersville Blower Corp., Connersville, Ind.* 132

High Pressure Boilers

Catalog No. 89, 8 pages in three colors, describes Kewanee Hi-Test, portable, two-pass, tubular, fusion welded boilers for high pressure steam and power service and industrial processing. Boilers come in six sizes, from 50 to 150 hp, supplying 125 and 150 lb steam pressure, and they range from 7,000 to 25,500 sq ft of steam radiation.—*Kewanee Boiler Corp., Kewanee, Ill.* 133

Unit Heaters

A 12-page illustrated booklet gives details and capacity tables on grid type unit heater with high test cast iron heating sections. Construction of the one piece cast heating section said to withstand steam pressures up to 250 lb is described.—*D. J. Murray Manufacturing Co., Wausau, Wis.* 134

Color Conditioning

A 3-page booklet describing with full color illustrations the Du Pont system of "Three-Dimensional Seeing" for the painting of industrial machines as well as the safety color code for industry. Color conditioning is shown at work in plants of several well-known companies.—*E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Delaware.* 135

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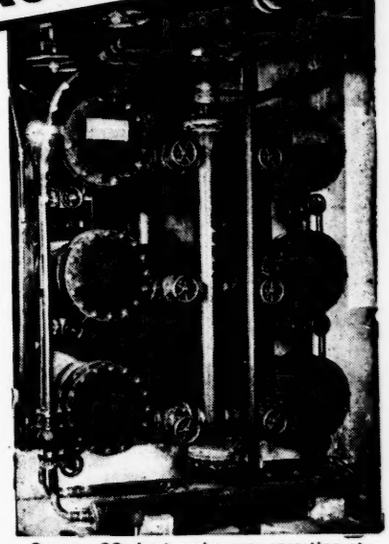

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District Heating

Steam Sales Improve Operation of Municipal Power Plant is the title of a 10-page, standard size booklet covering the case history of the Piqua (Ohio) Municipal Power system which several years ago went into the business of selling steam to nearby industrial plants. The booklet outlines advantages to utilities of selling steam in addition to electricity, and also advantages to customers in bringing power costs and manpower savings, and greatly reducing smoke nuisance. Tells how one plant was able to save over $20,000 per year by purchasing steam. Illustrated with photographs and blueprints, contains cost figures and other technical data. Installation of underground steam conduit is told in detail with actual installation photographs. — *The Ric-wiL Co., 1563 Union Commerce Bldg., Cleveland 14, Ohio.* 136

Vertical Centrifugal Pumps

A new 6-page bulletin describes the design, construction and application of three types of Peerless vertical centrifugal pumps for general purpose pumping in industrial services such as sump and drainage pumping, water supply, main, or cooling tower service, etc.—*Peerless Pump Division, Food Machinery Corp., 301 West Avenue 26, Los Angeles 31, Calif.* 137

Diesel Engine Cooling Systems

A 20-page, two-color booklet, Bulletin 351, describes diesel engine cooling systems, illustrated with photographs, diagrams and blueprints. The booklet contains tables of dimensions and shows how water jacket scale, overheating, etc., can be overcome. Area rating tables show the effective heat exchanger area required per 100,000 Btu per hour. Spray tower and induced draft cooling towers are described and illustrated.—*Binks Manufacturing Company, 3114-40 Carroll Ave., Chicago 12, Ill.* 138

Vapor Equalizing Valves

Bulletin No. 114, 4 pages, 2 colors, describes Gorton vapor equalizing valves and air eliminators for equalization of steam or vapor heating systems.—*Gorton Heating Corp., Cranford, N. J.* 139

Arc Welding Film

"Design For Arc Welded Structures" is a new motion picture produced to assist architects, engineers, contractors and all people in the structural field to visualize the improvements in design and construction which are made possible by using arc welding. The picture also explains the tremendous possibilities of tubular construction and rigid frame design for more efficient use of materials and better appearance. The film, which has a running time of approximately 15 minutes and was produced by Herb Lamb Productions, is available in 16 mm sound color prints at no charge except for transportation.—*The Lincoln Electric Co., 12818 Coit Road, Cleveland 1, Ohio.* 140

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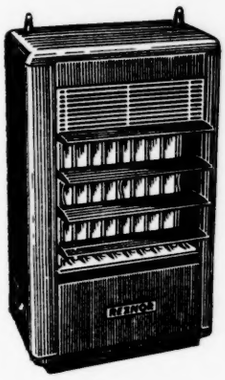

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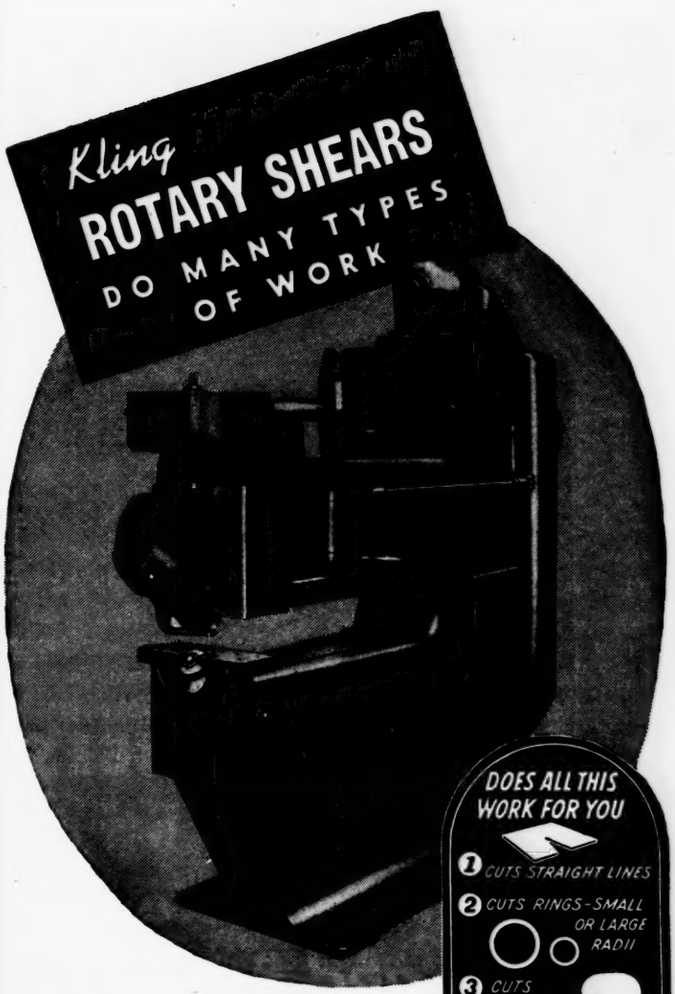

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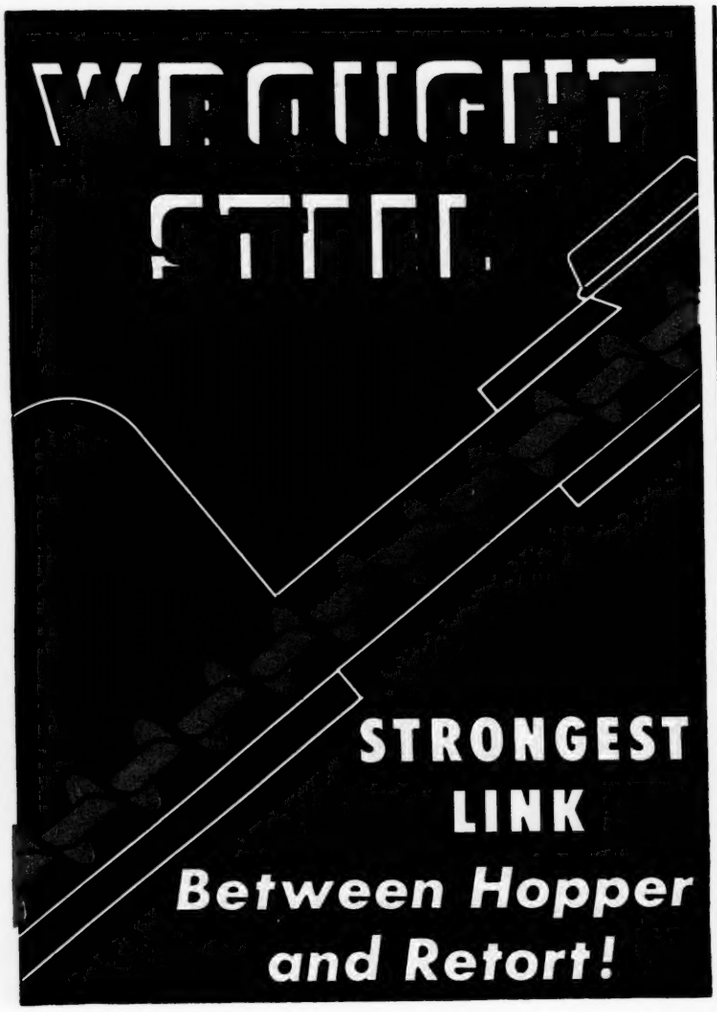

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Instruments

Catalog 345, 80 pages, illustrated, describes industrial thermometers, hygrometers, manometers, recording instruments, controls, motor valves, pressure reducing valves, gages and special apparatus designed for temperature and material handling controls.—*Thermal Industries Inc., Detroit 26, Mich.* 142

Perforated Metals and Screens

A 128-page catalog in two colors, shows a line of perforated metals, screens, and fabricated metal products. Actual size illustrations show 390 shapes and sizes of openings in perforated metals. Metal screens include screens for sizing and dewatering. There is a section on ornamental perforated metal grilles, open steel flooring, and stair treads. The catalog concludes with 19 pages of useful tables for workers in any metal industry.—*Hendrick Manufacturing Co., Carbondale, Pa.* 143

Insulation

The cost of bare surface heat losses is the subject of a new 20-page manual prepared for process engineers and power men. Booklet includes tables for reading the dollar savings per foot of pipe of various sizes accruing as a consequence of proper insulation. Nine case histories are detailed. Descriptions and pictures of the various forms of mineral wool insulation are presented.—*Industrial Mineral Wool Institute, 441 Lexington Ave., New York 17, N. Y.* 144

Prefabricated Pipe

Under the title, "There is No Substitute for Work," a two page folder expands editorially on production. The last page of the folder deals with the prefabricated pipe products and operating policies of the company. —*The Sawhill Manufacturing Co., Sharon, Pa.*.....145

Concrete Shrinkage

Shrinkage of concrete and mortar, its influence on durability and serviceability, the principal factors affecting shrinkage, and its control and elimination are discussed in a 34-page booklet, "The Action of Embeco in Concrete and Mortars." Booklet explains the principle of specially prepared metallic aggregate in controlling shrinkage.—*The Master Builders Co., 7016 Euclid Ave., Cleveland 3, Ohio.* 146

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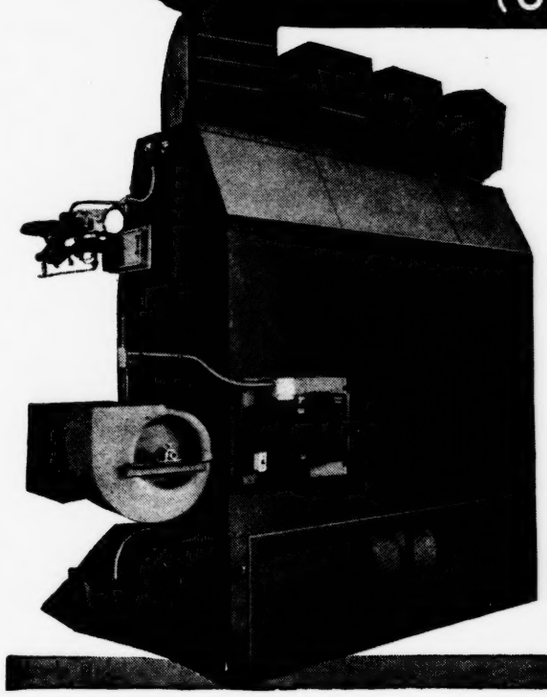

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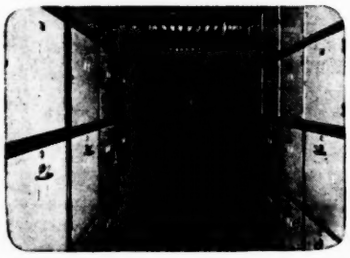

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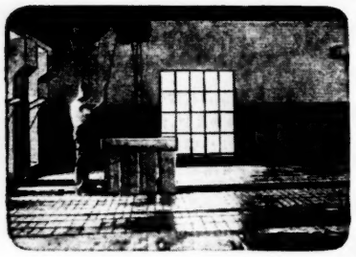

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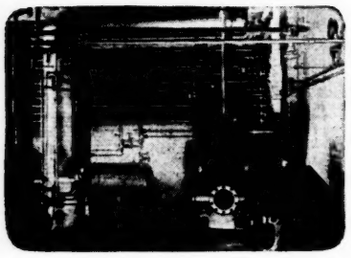

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Freon Water Coolers

A 12-page, two-color booklet describes dry expansion type coolers with standard construction specifications, selection data, and a direct reading log. mean temperature difference chart.—*The Patterson-Kelley Co., Inc., East Stroudsburg, Pa.* 147

Electric Generators

An 8-page bulletin in two colors describes direct current and alternating current generators, capacities from 50 watts to 200 kilowatts, with a variety of sizes and application designs.—*Century Electric Company, St. Louis 3, Mo.* 148

Radiant Baseboard

A new version of the radiant baseboard which is said to deliver approximately 60% more heat for its size and is intended for large areas, or rooms with wide expanses of windows, has been announced in a new, 4-page, illustrated folder.—*Burnham Boiler Corp., Irvington, N. Y.* 149

Flow Rate Instrument

Bulletin 40-A describes armoured, variable-area, flow rate, meters. This line of Rotameters is designed specifically for high pressure, high temperature handling of hazardous gases or liquids where an exposed glass tube might be dangerous or impractical.—*Fischer & Porter Co., Department IT-7, Hatboro, Pa.* 150

Centrifugal Pumps

Bulletin W-341-B11 describes saddle mounted, vertically split, centrifugal pumps for boiler circulation and heater drain service.—*Worthington Pump and Machinery Corp., Harrison, New Jersey.* 151

NOVEMBER, 1946

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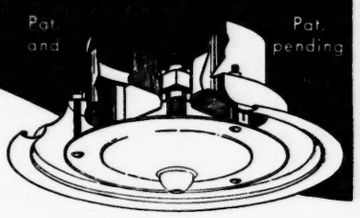

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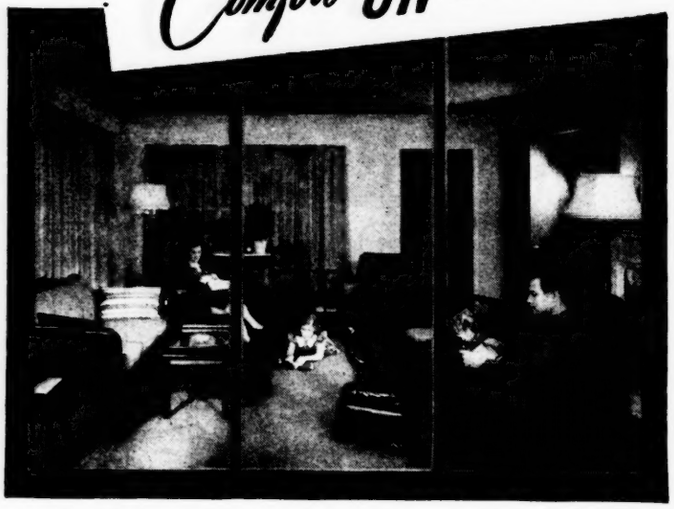

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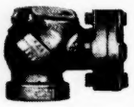
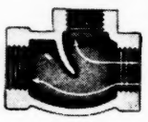
There's only one reason for the existence of today's heating industry: Man's desire-demand for winter comfort. Realizing this, most successful dealers talk to customers first in terms of results—then in terms of furnaces and equipment.

That's why Triplex dealers are fortunate. They can sell *comfort unlimited*—unvarying comfort that results from hot water heating at its best! The advanced design and precision construction of all Triplex Flow Control Units assure the most efficient, dependable operation possible. Hot water is automatically circulated, abundant heat supplied to radiators instantly—whenever and wherever needed. Third floor north is just as comfortable as first floor south, for Triplex Units automatically balance heat loss with heat supply. Ample hot water for domestic use is also provided at practically no additional cost. So learn more about the full Triplex line and what it can do for you. Write for catalog today.

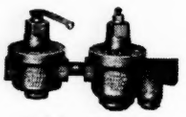
Direct Drive Circulators



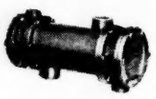
Flow Control Valves



One-Pipe Distributors



Relief and Pressure Reducing Valves



Indirect Heaters

Triplex

HEATING SPECIALTY CO., PERU, INDIANA

In addition to units illustrated, the Triplex line includes—Direct Drive Horizontal Circulators, Indirect Drive Circulators, Expansion Tanks, Air Eliminators, Water Mixing Valves, Air Vent Valves, Tankless Heaters, Control Units, Electrical Controls, Barometric Draft Dampers, Sump Pumps.

SEE YOUR WHOLESALER TODAY

. . . Since the Last Issue

Eric V. Olsson, active in the air conditioning and ventilating field since 1934, has been appointed manager of the Washington, D. C. office of the **B. F. Sturtevant Co. Division of Westinghouse Electric.** In addition to the district of Columbia, Mr. Olsson also will be responsible for directing the sales and engineering application of Sturtevant products in the Richmond, Va., and Charleston, W. Va., territories. The new manager has served in the Company's offices in New York, Boston, and Hartford, Conn. A native of Bridgeport, he studied mechanical engineering at New Haven College. He is a member of the Connecticut chapter of the ASHVE.

Carroll M. Baumgardner, executive vice president of the United States Radiator Corp., Detroit, Mich., has been elected chairman of the executive committee of the **Institute of Boiler and Radiator Manufacturers** at the Institute's annual meeting in Atlantic City, N. J. Mr. Baumgardner succeeded A. E. Bastedo, vice president and treasurer of the Burnham Boiler Corp., Irvington, N. Y. IBR, with headquarters at 60 East 42nd St., New York City, is a non-profit organization of manufacturers established to promote research and standardization of practice in the use of hot water and steam heating systems.

C. M. Baumgardner

Ben W. Bittner has joined the staff of the Industrial Division of **Bryant Heater Co.,** Cleveland, as sales engineer. A member of The American Society for Metals, Bittner was previously associated with General Alloys and North American Manufacturing Co. in a sales engineering capacity, and with Crucible Steel Co. as combustion engineer.

The **ASRE** has announced the appointment of **Fred C. Kelly, Jr.,** of New York as Editor of "Refrigerating Engineering," the monthly journal of that society. Prior to assuming his new position he was employed by the firm of Johnson-Cushing-Nevell where he was engaged in writing and editing Ordnance Manuals for the Army and Navy.

A new headquarters building has been opened by the **Minneapolis-Honeywell Regulator Co.,** in Los Angeles. The new building, a modernistic structure at 2840 East Olympic Boulevard, will represent a completely integrated branch of the company, housing all divisions: heating and air conditioning controls, industrial, aeronautical, contractor, original equipment and jobber-dealer.

Two new representatives have been appointed by **Automatic Devices Co.,** 53 W. Jackson Blvd., Chicago, to handle Weather-Man Controls. **Williams, Critton & Wilde,** Salt Lake City, will cover Utah and parts of Wyoming, Idaho and Nevada. **E. M. Clary,** Atlanta, Ga., will cover Georgia, Alabama and Florida.

Homer L. Hosking, formerly vice-president of the United States Radiator Corp. and its Pacific Steel Boiler Division, has been elected president of the newly-formed **Republic Boiler Corp.** with headquarters at 30 Church Street, New York City. Willard Scott is Secretary. The Company will handle all sales for Republic Residential Steel Boilers which will be manufactured in sizes ranging from 400 sq ft to 1,800 sq ft.

Easy, Fast Soak CLEANS Kitchen Grease Filters!

Restore grease-clogged kitchen filters to maximum filtering capacity by first removing and then immersing them in recommended solution of Oakite Composition No. 20. The high-speed detergent action of this specialized alkaline-type cleaner makes short work of dirt, grease and other deposits. A simple soak—and peak airflow is regained . . . flash fire hazards no more!

For the kind of experienced service that pays off in better operation, longer life for housekeeping equipment . . . start now to shoot your maintenance-cleaning problems to Oakite! Oakite service in your locality is convenient, free. Use it NOW! Or write direct for helpful, no-cost data.

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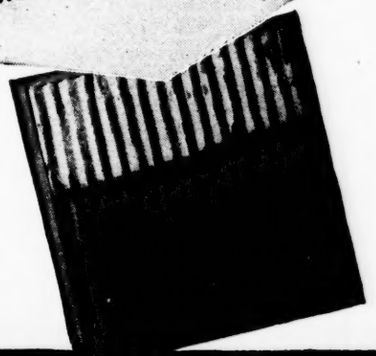
OAKITE *Specialized* **CLEANING**
MATERIALS · METHODS · SERVICE · FOR EVERY CLEANING REQUIREMENT

NEW TURCO METHOD
CLEANS AIR FILTERS IN 15 MINUTES!
STOPS FIRE HAZARD—NO ODOR
NON-INJURIOUS TO METAL

With Turco's new method of cleaning air filters, no special equipment or skilled help is needed. A solution of Turco Aktiv is used in a cold tank. The loosened dirt and grease are easily flushed away with cold water hosing. Filter is dried in stream of air. The Turco Aktiv method has been tested and approved by leading air filter manufacturer.



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IT'S RUST INHIBITING

Because B-H No. 1 Cement contains a rust inhibitor which prevents corrosion of metal surfaces, it is excellent for use on flanges, valves, and other fittings. Even if used on cold, slow drying surfaces it forms a firm, rust-free bond.

IT'S EASY TO APPLY

Just mix B-H No. 1 Cement to a trowelable consistency and apply. It sticks, even to smooth surfaces—makes covering of under surfaces and pipes easy, even for unskilled workmen.

IT'S EFFICIENT

The exceptional efficiency of B-H No. 1 Insulating Cement is due to the high temperature resistant *black* rockwool from which it is made. The dead air cells in the nodules of rockwool provide maximum insulating efficiency and lightness in weight. B-H No. 1 Insulating Cement dries without cracking—withstands temperatures of 1800° F.—and is reclaimable if temperatures have not exceeded 1200° F.

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Packed in convenient sized multiwall paper bags containing 50 lbs. Ready for instant use. There is no loss or breakage as with molded types of insulation.

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Specialists in thermal insulation products

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Send information on products checked below

- ☐ Free sample of B-H No. 1 Cement
- ☐ No. 100 Pipe Covering—effective up to 1200° F. (for long runs overhead, underground, Diesel exhausts).
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- ☐ Black Rockwool Blankets (felted between various types of metal fabrics).

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THE AMAZING NEW

ARCTIC CIRCLE EVAPORATIVE COOLER

Available in sizes 1,500 to 15,000 C.F.M. Fan or Blower types

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INTERNATIONAL METAL PRODUCTS COMPANY

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The appointment of **Eugene Somoff** to the newly created post of technical service engineer was announced by the **American Standards Association.** Mr. Somoff, an electrical engineer with wide experience in Russia, Belgium, Great Britain, and the United States, will collect and supply technical information concerning American standards and those of other countries. He will conduct world wide surveys of standards available in any particular field for use by committees of the ASA and his service will also be available to ASA company members and the association's own engineering staff.

A. B. Campbell, formerly eastern representative of Hughes Brothers, has accepted the position of executive secretary of the **National Association of Corrosion Engineers,** with headquarters in Houston, Texas. Mr. Campbell is a graduate in electrical engineering of the University of Illinois. He was an engineer on the headquarters staff of the NELA and the EEI from 1923 to 1943, at which time he joined Hughes Brothers. The new executive secretary is a fellow of the AIEE.

Started in 1943, the National Association of Corrosion Engineers serves as a clearing house for the exchange of corrosion information, and for the establishing of standard procedures and methods of carrying them out. NACE will hold its second national convention in Chicago on April 7-10 at the Palmer House.

Tyler S. Rogers of Toledo, O., has been elected president of the **Producers' Council,** national organization of building product manufacturers. Mr. Rogers, who is assistant to the executive vice president of the Owens-Corning Fiberglas Corp., was vice president of the Council for the past year and had served for three years on the board of directors. In addition, he had been chairman of the organization's Technical Committee. Prior to moving to Toledo in 1939, the Council's new president was vice president of Taylor, Rogers, and Bliss, Inc., marketing consultants in New York City, and then became managing editor of the American Architect and Architecture. He is author of a book entitled "Plan Your House to Suit Yourself," and of various magazine articles in the field of construction. Mr. Rogers is a graduate of Massachusetts State College and did graduate work at the Harvard University School of Landscape Architecture and City Planning.

A new product styling service is offered without cost to users of Redmond Micromotors. **Redmond Company, Inc.,** Owosso, Michigan, has retained the services of a styling organization, Bruce Kamp Associates, with offices in Philadelphia and New York. The service includes product design, styling, colors, materials and packaging.

A complete line of blast coils, unit heaters, fans and blowers will be manufactured by the newly formed **Chicago Fan & Fin Coil Co., Inc.,** 1937 W. Walnut St., Chicago. The officers are **E. A. Chartier, president;** John R. Mitchell, vice-president; **C. J. Banach,** secretary-treasurer and design engineer, and **Frank Freitag,** vice-president and superintendent.

Anthracite Institute announces the appointment of **John G. Howley** as Philadelphia district manager, located at 1617 Pennsylvania Blvd. Mr. Howley joined Anthracite Institute in 1943 as a field representative in the Philadelphia territory. He has been connected with the heating industry since 1919, having worked in various capacities in the plumbing, heating, and engineering fields. Mr. Howley assumes the duties of Richard A. Protheroe, who has resigned after nine years with Anthracite Institute to become executive director of the Philadelphia City Planning Exhibition.

Several important executive personnel changes within the **Chase Brass & Copper Co.** were announced recently. **Wallace C. Husted,** vice-president in charge of all activities of the company in the Cleveland area, will be transferred to Waterbury and placed in charge of organization and plant operations under Richard D. Ely, vice-president in charge of production. **John S. Coe,** who has been assistant to Mr. Husted in Cleveland, has been elected a vice-president of the company and will be in charge of all activities in the Cleveland area. Also announced was the election of **Richard R. Quay,** counsel for the company, as an assistant secretary.

L. S. Cline

L. S. Cline has been elected treasurer of **The National Radiator Co.,** Johnstown, Pa. Mr. Cline was formerly controller of Eversharp, Inc., Chicago, and was controller, assistant treasurer and secretary of the American Hoist and Derrick Co., St. Paul, Minn. for a number of years. He is a graduate of the University of Illinois and has a wide experience in accounting and finance.

The regular quarterly meeting of the board of **Oil Heat Institute of America** was held October 23 at the Edgewater Beach Hotel with President W. A. Matheson presiding. On a reconsideration of an exposition and convention for the Spring of 1947 the board voted to hold a convention only, in conjunction with the annual meetings, at the Traymore Hotel, Atlantic City, during the week of March 24, 1947. A convention committee was appointed with W. A. Matheson, chairman, and R. S. Bohn, R. M. Sherman, W. A. Kemp, and C. R. Jonswold as members. The board authorized finalizing of arrangements for an exposition and convention at Chicago during the week of April 4, 1948. The exposition will be at the Coliseum and the headquarters hotel will be the Palmer House.

Bituminous Coal Research, Inc., announced that **James R. Garvey,** former captain in the U. S. Army Air Corps, has been added to its development engineering staff to expedite production and home testing of BCR smokeless stoves. He will be associated with Dr. Harold J. Rose, vice-president and director of research. After graduation in 1941 from Ohio State University, where he obtained a degree of Bachelor of Engineering in Mining, Mr. Garvey was employed by the Pittsburgh Coal Company. He resigned from Pittsburgh Coal, after more than a year's service, to enter the Air Corps.

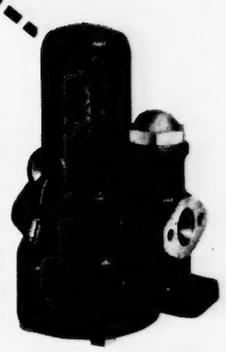
A group of 45 new sales and service engineers has been added to the expanded field staff of the **Brown Instrument Co.,** Philadelphia. The group will be assigned, about the first of the year, to various regional offices and branches throughout the country. All of the men are now attending the Brown Company School of Instrumentation at Philadelphia.

Completion of a new **Chrysler Corp.** engineering laboratory at Dayton to be devoted to air conditioning, heating and refrigeration research and development, was revealed during the all-industry show in Cleveland last month.

The research building is now in full operation and facilities include separate rooms for testing of packaged air conditioning units, room coolers, condensing units, rating of large and small compressors, and a room for testing the various types of heating equipment. Three big cold rooms have been designed to maintain temperatures of zero, 70 below, and 240 degrees below zero, respectively.

A *Good Investment* IN "AIR CONDITIONING DEPENDABILITY"...

A-P DEPENDABLE REFRIGERATION VALVES



When you install A-P Dependable Refrigeration Valves on your best air conditioning systems you're getting factory-proven, field-proven valves that most engineers know will aid them to peak operating efficiency. A-P Thermostatic Expansion Valves are famous for their extreme sensitivity and close superheat control, even under wide variations in load. And A-P Solenoids are versatile, quick-acting, require minimum power, and can be depended on for long trouble-free service . . . And the same over-all *dependability* is built into all the other vital A-P Refrigeration Valves — Suction Pressure Regulating Valves, Water Regulating Valves, "Trap-Dri" and "Trap-It" System-Protectors, Water Solenoids and Cooling Thermostats.

MODEL 70-NA

Solenoid Refrigerant Valve. Compact, rugged, leakproof — high capacity, up to 20 tons Freon — requires little power.

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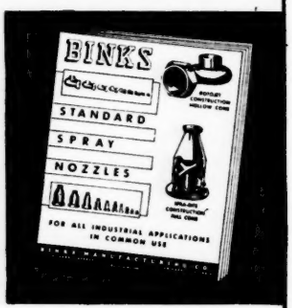

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At a meeting of the metropolitan New York section of the **American Industrial Hygiene Association**, two papers were of particular interest to heating and ventilating engineers. An improved, portable anemometer, using a thermocouple adaptation of Yaglou's two-thermometer anemometer, was described in a preliminary report by William B. Harris of the New York State Department of Labor. The instrument, powered by flashlight batteries, can give a direct reading in feet per minute on an ordinary calibrated meter. Another paper, by E. H. R. Pegg of Aerotec Co., described a system of combining centrifugal dust separation and electrostatic precipitation in the cleaning of industrial air. Other papers at the meeting covered X-ray diffraction for chemical analysis, health hazards of beryllium, and estimation of sulphur compounds in air.

Getting Personal

G. D. Winans

Glen D. Winans *(Central Heating in Detroit*, page 64), was born at Plymouth, Mich. He received his Bachelor of Science degree in Mechanical Engineering at Ohio Northern University in 1921.

After leaving school, he went to The Detroit Edison Co., Central Heating Department, where he is now Assistant Superintendent of Central Heating in charge of distribution and customers' relation. He has been active in the American Society of Heating and Ventilating Engineers and the National District Heating Association.

Mr. Winans is author of several technical papers on distribution and utilization. He is a member of the Engineering Society of Detroit, and the A.S.H.V.E.

C. B. Sprenger

C. B. Sprenger *(Serving a Large Detroit Hotel With Purchased Steam*, page 71) is an engineer in the Central Heating Department of The Detroit Edison Company. He is a mechanical engineer graduate from The University of Notre Dame, and for several years supervised the operation of a district heating system in South Bend, Ind., owned by The Indiana and Michigan Electric Co.

He joined The Detroit Edison Company in 1928 and has been very active in utilization work among the large office buildings in Detroit which purchase Detroit Edison Steam, and also active in planning the changes required to convert to purchased steam.

Mr. Sprenger is a member of The National District Heating Association, and the Engineering Society of Detroit.

George R. Morgan *(Avoiding Wet Walls in High Humidity Industrial Plants*, page 74) was born in Greenville, South Carolina, and received his B.S. degree from Clemson

A&M College in 1914, and his M.E. degree from Cornell University in 1916.

His experience embraces teaching, electrical contracting, sales engineering, and consulting and designing engineering.

He became a partner in the firm of J. E. Sirrine & Company, Engineers, Greenville, South Carolina, in 1937, which firm has been active for 45 years and is widely known in industry, especially in the textile and paper fields. He is head of the steam power department and is responsible for all designs relating to boilers, turbines, heating, humidifying, ventilating, air conditioning, compressed air, and process piping.

He is a member of the ASME and the ASHVE and is a registered professional engineer in South Carolina, North Carolina, Georgia, Kentucky, and Ohio.

COMING EVENTS

WEEK OF NOVEMBER 11, 1946—74th Annual Meeting of the American Public Health Association, to be held in Cleveland, Ohio. Further details from Dr. Harold J. Knapp, Health Commissioner, Cleveland, Ohio.

NOVEMBER 17-22, 1946—Annual Meeting, American Welding Society, Hotel Ambassador, Atlantic City, N. J. Office of Secretary, 33 W. 39th St., New York 18, N. Y.

NOVEMBER 18-22, 1946—28th Annual National Metal Congress and Exposition, Municipal Auditorium, Atlantic City, N. J. Secretary, W. H. Eisenman, American Society for Metals, 7301 Euclid Ave., Cleveland, Ohio.

DECEMBER 2-7, 1946—17th National Power Show, Grand Central Palace, New York. Charles F. Roth, manager, International Exposition Co., Grand Central Palace, New York 17, N. Y.

DECEMBER 15-18, 1946 — Annual Meeting of American Society of Refrigerating Engineers, Hotel Pennsylvania, New York, N. Y. Secretary, David L. Fiske, 40 W. 40th Street, New York 18, N. Y.

JANUARY 14-17, 1947 — Materials Handling Exposition, Public Auditorium, Cleveland, Ohio. Exposition management, Clapp & Poliak, Inc., 37 Wall St., New York.

JANUARY 27-31, 1947—7th International Heating and Ventilating Exposition, Lakeside Hall, Cleveland, Ohio. Sponsored by The American Society of Heating and Ventilating Engineers in conjunction with their 53rd Annual Meeting. Charles F. Roth, manager, International Exposition Co., Grand Central Palace, New York 17, N. Y.

MARCH 24-29, 1947—Annual convention, Oil Heat Institute of America, at Hotel Traymore, Atlantic City, N. J. For details write the institute at 30 Rockefeller Plaza, New York 20, N. Y.

APRIL 7-10, 1947—Annual Convention of The National Association of Corrosion Engineers, Palmer House, Chicago, Ill. Executive Secretary, Elton Sterrett, 905 Southern Standard Building, Houston 2, Tex.

Specify

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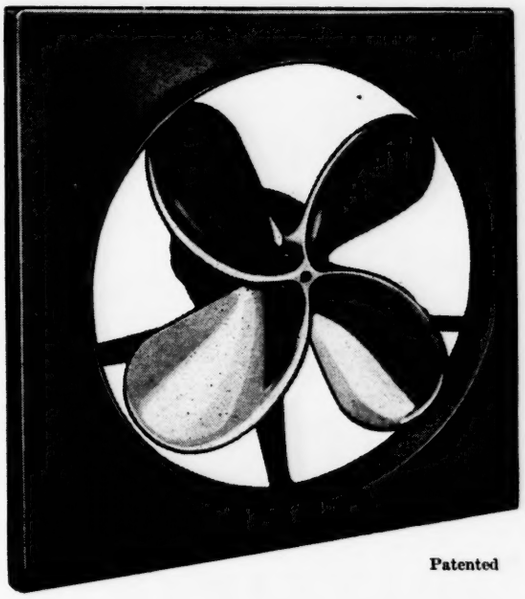

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EXHAUST FANS

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Reduce ventilating cost thru quiet, efficient straight line exhausting.

Trouble free performance and dependability of Stilphen "Stil-Blade" Exhaust Fans is due to patented design of fan blade. Reverse curve at back edge of fan blade reduces air friction and eliminates eddy currents and dead centers. Air flows over the entire surface of the fan blade in a smooth continuous stream.

Fan wheel is cast in one piece of aluminum alloy, eliminating chance of blades working loose to throw the fan out of balance. Manufactured in a variety of sizes from 10" to 40"

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